Scanning - Shortwave - Ham Radio - Equipment
Internet Streaming - Computers - Antique Radio

Monitoring Times

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The Great Project 25 Boondoggle: 22 years in search of interoperability

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In this issue:

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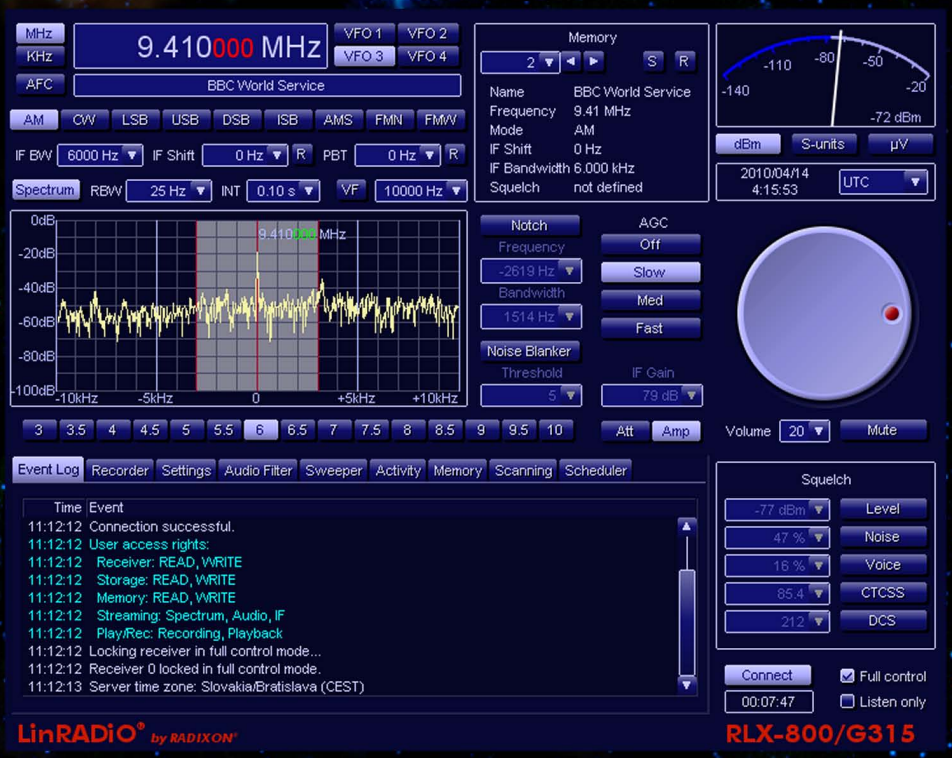

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Monitoring Times

Vol. 30 No. 2 February 2011

The Great Project 25 Boondoggle 8

By Kirk Kleinschmidt NT0Z

The need for radio interoperability, a plan where public service agencies from local to national levels are able to easily contact each other in times of man-made or natural disaster, did not stem from the events of September 11, 2001, as Kirk Kleinschmidt details in this special report.

After 22 years on the road to interoperability, why does it seem that we're on a two-lane blacktop constantly in need of repair? Between slow-footed federal agencies (including the FCC), overzealous sales staff, uninformed government buyers, and apparently design-on-the-fly radio systems, Kirk has found that there's plenty of blame to go around.

What will the future of public service radio actually be? Kirk believes it may look and act less like a radio and more like a computer; a very expensive computer.

On Our Cover

A police officer using a Harris Unity-series P25 hand-held radio (Courtesy: Harris Corporation)

C O N T E N T S

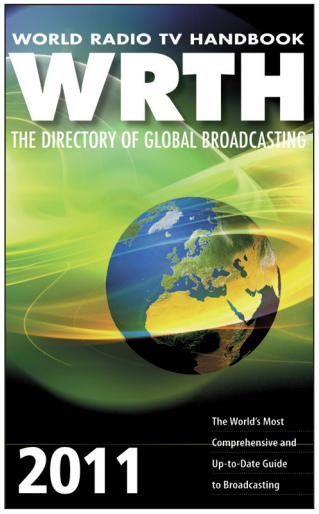
R E V I E W S

We are very pleased to announce the publication of the 2011 edition of *World Radio TV Handbook*, the bestselling directory of global broadcasting on LW, MW, SW & FM

The Features section has an account of the history of Radio St Helena, reviews of the latest equipment, an intriguing look back at some classic 80s & 90s receivers, a visit to AFN in the Florida Keys and much more, including our regular *Digital Update*.

The remaining pages are, as usual, full of information on:

- National and International broadcasts and broadcasters by country with frequencies, powers, languages, contacts, and more, including Clandestine and other target broadcasters
- MW frequency listings by region. International and domestic SW frequency listings, as well as DRM listings
- International SW broadcasts in English, French, German, Portuguese & Spanish.
- Reference section with Transmitter locations, DX clubs, Internet Resources, and much more



Available December 2010

SOME COMMENTS ON WRTH 2010

The 2010 *World Radio TV Handbook* continues to set the radio hobby standard. It remains the best, most authoritative and comprehensive radio reference book in the world
– Gayle Van Horn W4GVH, Monitoring Times

Essential, could not do without it! *– Glenn Hauser, DX Listening Digest*

WRTH gives you more info about a broadcast than any other radio reference book with which I'm familiar. This is one of the reasons it has become a staple reference for serious radio listeners
– Thomas Witherspoon, SWLing.com

WRTH's claim to be the World's most comprehensive and up-to-date guide to broadcasting is indeed more than justified. At Radio Netherlands Worldwide, we couldn't be without it. If you like listening to radio broadcasts from abroad, neither can you
– Radio Netherlands Media Network review

I have just received my 2010 edition of the famous *WRTH* and it's packed with 672 pages of invaluable information. There is no other publication in the world that rivals *WRTH*. It is indeed the ultimate volume for anyone with an interest in radio *– Mike Terry, UK*

The *WRTH* 2010 is, as usual, indispensable and accurate. More necessary now than ever before
– Gil Torbeck, Germany

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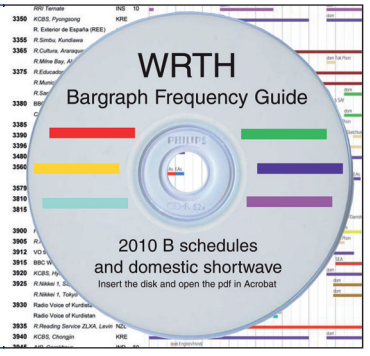

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COMMUNICATIONS

by Ken Reitz

AMATEUR RADIO/SHORTWAVE

Radio Martí Tries Chat Show Approach

The Broadcasting Board of Governors, as part of its rebranding effort, reports that Radio Martí began a new call-in show in early December called "Con Voz Propia" (With Your Own Voice). The daily show, which is hosted by four women, talks about women's issues and allows Cuban women within Cuba to participate by calling in, a risky proposition in a country where limited cell phone use is a new idea; listening to such American broadcasts is banned, and where the transmissions are jammed.

Shortwave Loses Four More

You have heard the last of RAE Argentina and Radio Slovakia; now say "so long" to Iceland and Prague on the shortwave bands, according to Gayle Van Horn's blog, *Shortwave Central* (**www.mt-shortwave.blogspot.com**).

Radiodifusión Argentina al Exterior

KNR Kalaallit Nunaata Radioa Greenlandic Broadcasting Corporation

The posting indicated that Iceland planned to cease its 3.815 MHz shortwave service from Tasiilaq as well as 5 medium wave services that carried KNR Radio Iceland programming on February 11. Expense of replacing antiquated transmitter facilities was cited as the reason for the closing. Failing a last-minute reprieve, Radio Prague will have stopped its shortwave presence January 31, citing budget cuts in a nationwide austerity program. Prague will continue to be available via satellite and online while KNR will only be available via low-power FM in the inhabited areas of Iceland.

AM/FM/TV BROADCASTING

Arbitron: Radio Usage Up

It was nothing but good news for radio broadcasters from Arbitron, the media and marketing research firm, which released highlights from its *National Radio Listening Report* in mid-December showing an increase of 3.3 million radio listeners age 12 and older per week compared with their 2009 report. It noted that radio listening increased in all major demographics, with adults 18-34 showing the biggest gains. Even teens 12-17 years old listened to more radio in 2010 over 2009.

College Radio Slumps

Still got your party hat on from the previous story about Arbitron? Well, the college crowd of today aren't faring nearly so well. An article in the *New York Times* from the same week headlined, "Waning Support for College Radio Sets off Debate."

The article examines the woes of two major universities that are cashing in their radio station licenses: Rice (KTRU-FM) and Vanderbilt (WRVU-FM). Vandy wants to make the radio station strictly online and save the bucks, claiming their kids don't listen anyway. Meanwhile, Rice wants to sell its station, a 50 kW presence in Houston, to the University of Houston for $9.5 million. Apparently U of H students are still interested in radio.

INTERNET/SMARTPHONES

Fears of Cell Network Collapse

New Scientist writer Jim Giles, in an article published in the *Washington Post*, warns that "data-gobbling smartphones" are the source of network overload which he says is especially acute in cities where there's a concentration of people using the devices. He points out that, since 3G networks were first built ten years ago, the landscape of users has reached a critical mass with more than 50 million iPhones now in use and millions more Droids and other 3G and 4G devices depending on those networks. Overcrowding, many speculate, will lead to the first mobile meltdowns by 2013.

Until now, cell phone companies used more advanced technology to improve capacity. But the quantity of phones and practice of constant streaming is outstripping the capacity to improve the technology. Giles notes that a streaming video still takes up as much bandwidth as 100 phone calls and those tens of millions of heavy data users are clogging the lanes of the information highway. One solution – setting up additional infrastructure where Over-the-Air TV currently resides – will take more time than the looming collapse suggests we have.

Instead, Giles suggests the use of "femtocells," router-like cell phone transmitters in every home and office that would plug into broadband connections, thus taking the traffic off the less efficient 3G and 4G networks and putting it directly onto the web.

FCC Lays Out Spectrum Changes

Business Week reported that the FCC voted 5-0 in late November to explore ways to free up TV bandwidth and make it available for smartphones, mobile Web use and mobile TV reception as part of the Obama administration's plan to double bandwidth access for such devices.

The first such step would be to ask OTA TV broadcasters to voluntarily share existing UHF-TV capacity. Stations in various markets could be paid to relinquish their assigned frequency and join the transmission of another in-market station on that station's broadcast space.

FCC chairman Julius Genachowski is quoted in the article as saying, "The explosive growth in mobile communications threatens to outpace the infrastructure…If we don't act to update our spectrum policies for the 21st century, we're going to run into a wall, a spectrum crunch."

Companies Team-up for Mobile TV

Don't think that TV broadcast companies are sitting on their hands while the FCC auctions off their spectrum for cell phone video streaming competitors. *TV Technology* reported at the end of November the formation of a company called Mobile Content Venture (MCV) composed of 12 major broadcast interests, including Fox, Ion, and NBC, who plan to launch at least two free (meaning ad-supported) mobile DTV channels in 20 top U.S. markets this year.

Mobile TV signals are sent via a station's ATSC transmitter, but are receivable so far on only a few devices. Washington, D.C. is one of a few cities currently transmitting mobile TV signals. Supporters of mobile TV point out the efficiency of broadcast video technology that doesn't limit the number of viewers, as 3G or 4G wireless broadband currently does.

SATELLITE

Russia Glonass GPS Disaster

Russian state news agency *Rianovosti* reported the loss of three new GPS satellites, destined to complete Russia's Global Navigation Satellite Systems (Glonass), shortly after launch in mid-December on a Russian Proton-

2012 Russian 7-seat, budget Lada may have to wait for its optional Glonass GPS system. (Courtesy: RIA Novosti)

M rocket from Russia's launch center in Baikonur, Kazakhstan. Russia had ambitious plans to launch eight more Glonass satellites over the next two years. Among companies depending on the success of the Glonass system is Russia's Soviet-era automaker Lada, which planned to make Glonass reception an option on its 2012 models.

Sirius Listeners Sentenced to 5 more Years

In 2005, a desperate Mel Karmazin, CEO of Sirius satellite radio, gambled on a half billion dollar 5-year contract with the self-proclaimed "King of All Media," Howard Stern, to jump on the slowly moving satellite radio bandwagon. This past December the aging shock-jock signed up for another fun-filled five years. Since those heady days, Sirius has merged with XM satellite radio to enjoy a broadcasting monopoly and subscription figures have gone from a combined 3 million to just over 20 million subscribers, for which, of course, Stern claims a great amount of the credit. Times have never been better!

But, in fact, these are hard times, and so, according to the *New York Post*, Stern had to settle for a mere $400 million for his new contract, though he denies he took a cut. Instead of having to do four live shows a week, he'll only have to show up for three. The rest of the time fans will get re-fried Stern antics from the past.

X-37B lands at Vandenberg Air Force base after 220 day secret mission. (U.S. Air Force photo/ Michael Stonecypher, USAF 30th Space Wing Public Affairs)

Spooky X-37B Returns

The Air Force's pilotless, secrecy-shrouded X-37B, also known as Orbital Test Vehicle 1 (OTV-1), returned to Earth December 3 after 220 days of low-earth orbit classified experiments. The 27-1/2 foot long, 5 ton OTV-1 mini space shuttle fired its orbital maneuver engine for an "autonomous reentry" before landing at Vandenberg Air Force base. The unmanned craft attracted the attention of amateur astronomers and spook monitors alike, as speculation on OTV 1's mission expanded to include the launch of secret spy satellites for the equally secretive National Reconnaissance Office.

Rooftop Antennas to Determine Eligibility

Broadcasting and Cable magazine reported in late November the FCC will stay with its current standard of rooftop TV reception to determine a household's eligibility to receive out-of-market TV signals via satellite. Satellite operators had wanted the Commission to change the OTA reception standard from the current outside antenna to an indoor antenna standard, as more customers would have qualified for out-of-market stations.

FCC ENFORCEMENT

Church Station without Staff: $10,000

Mid-November, an agent for the FCC was trying to find the main studio for religious broadcaster WQOR-AM 750 kHz Pittston, Pennsylvania and was escorted by a church employee to the second floor of a church building, part of St. Joseph Oblate Seminary. The main studio door was locked, but when opened there were no station personnel present.

Helpfully, the employee explained that the door was always locked and that no one associated with the station works at the main studio. The station engineer was called and arrived 30 minutes later to confirm the employee's information. A month later, a second FCC agent did a follow-up inspection and found exactly the same situation.

A call to the director and officer of J.M.J. Radio, the station's license holder, again confirmed that no one actually worked there. The agent informed the director of the rule requiring personnel to be present, which came as news to the director, who promised to see that someone would be there in the future. Too late: willful and repeated, that'll be $10,000 for the cash-strapped, employee-less station.

Chinese Co. Cited for Cell-Jamming Gear

Last summer an FCC agent surfing the Web came across an advertisement for a hand-held GPS and cell phone jammer from a company known as Jammer World/theJammerStore.com. According to FCC documents, the agent made an undercover purchase and confirmed on receipt that the device did indeed jam signals on the cell phone band, which is illegal. The FCC issued the Shenzhen, China company an official citation and warned that it would be fined $16,000 for each sale or each day of continued violation and up to $112,500 for any single act or failure to act. The citation noted that the company was still advertising sale of the product as of late November.

Station Fined for not Reducing Power

Ever notice that those AM stations allowed to operate after sunset only on reduced power always seem to be as strong night and day? So has the FCC, which received a complaint that KCKX-AM (Stayton, Oregon) was not lowering power at night. After hanging around a mile or so away from the station's transmitting antenna, field agents noted that station, operating at 1460 kHz at 1 kW daytime, did not actually reduce power to 15 watts as required by the station's license.

The agent asked a technical representative from the station to reduce power but, after a conversation with the contract engineer, discovered he was not able to do so. The owner of the station stated that he was aware of the requirements for power reduction but explained that it was, "just too expensive to maintain the calibrated time-keeping devices, power switching devices, and other equipment necessary to effect the timely change in power."

Oops, wrong answer: willful and repeated, that'll be $6,000. And, you'll still have to buy all that "expensive equipment."

Communications is compiled by Ken Reitz KS4ZR (kenreitz@monitoringtimes.com) from news clippings and links supplied by our readers. Many thanks for this month's fine reporters: Anonymous, Rachel Baughn, Harry Baughn, Bob Grove, Steve Karnes, Larry Van Horn.

After 22 years of political high jinks and good ol' American corporatocracy, the promise of a versatile, interoperable, spectrum-efficient, digital public-safety radio standard is still largely unrealized.

The Great APCO Project 25 Boondoggle

By Kirk A. Kleinschmidt NT0Z

On April 4, 2008, two Ohio firefighters were killed in a house fire when their radio calls were allegedly never received by fellow firefighters on the scene. According to a comprehensive post-incident investigation, which included a detailed review of the radio call logs, problems with the digital radio system were listed among key contributing factors.

On April 21, 2010, a Charleston, South Carolina, deputy was frantically radioing for help as he wrestled with a drug-fueled suspect, whom he had already Tazed, outside a local drug store. According to an article in the Charleston *Post and Courier*, fellow officers trying to help the besieged deputy heard only honks, whistles, beeps and distorted garble from their digital radios. The newspaper further reports that the county's new $17.5 million radio system, which already needs a $12 million "upgrade" just to make it functional, has experienced numerous communication failures "that have placed police, firefighters and civilians in jeopardy."

These reports are only the smallest tip of the iceberg. Similar problems with digital, trunked public-safety radio systems plague users from coast to coast. Despite the fact that only a small percentage of the problems with these complex systems are ever likely reported by the national news media, the list of recent local headlines is startling.

Charlotte, North Carolina: "Police Radio Blackout Hits Charlotte for Second Time in One Week."

Philadelphia, Pennsylvania: "Philadelphia's Digital Trunked Radio System Fails for the 15th Time in Three Years."

Milwaukee, Wisconsin: "MPD's Digital Radio System Down..."

Palm Beach, Florida: "Palm Beach County First Responders Lose Frequencies for More Than 45 Minutes."

There are dozens more, with new stories being added almost every day.

The rocky transition to trunked, digital public-safety radio systems is the common thread that runs through these stories, but it's the Association of Public-safety Communications Officials' Project 25 (known as APCO P25) – a set of standards aimed at defining the lion's share of present and future digital radio systems – that's really in the crossfire. The U.S. House Energy and Commerce Committee became so concerned that it recently called on the Federal Communications Commission to weigh in on the issue.

On July 20, 2010, at the request of Committee Chair Henry Waxman, FCC Chairman Julius Genachowski submitted a letter that made some surprisingly pointed and straightforward observations on the problems with trunked P25 digital radio systems and their likely obsolescence.

Among other things, Genachowski noted that, "proprietary solutions and market dominance play an important role in the problems with interoperability, innovation, cost and competition" in the market for public-safety communications systems; that after 20 years in the making, P25 systems rely on proprietary solutions that lack the benefit of market competition based on truly open standards; that "the current structure of the public safety equipment market may hinder efforts to achieve interoperability for a broadband public safety network" (a technology that could, and some say should, replace P25 technology altogether); and that public safety applications and services should be based on open, global standards.

In his letter, Genachowski cites a June 9, 2010, *Washington Post* article that placed Motorola's share of the public-safety radio systems market at 80%. Other manufacturers with significantly smaller market shares include Harris, Thales, EADS, Kenwood and RELM Wireless. So when the FCC Chairman's letter refers to "proprietary solutions," "market dominance," "lack of open standards," etc, it's reasonable to read between the lines and assume that the chairman is referring to Motorola and its lion's share of the action.

In fact, Motorola has been at the center of the public safety radio market since one-way AM radios were first installed in police vehicles in 1936. John Muench, a Motorola director of business development, says the company was present at the start of the P25 effort and is a key industry player when it comes to shaping P25 standards and moving them forward. "Motorola has shipped more than 1.75 million hand-held and mobile P25 radios to date," says Muench, and more than 75% of the US population is covered by Project 25 radio technology."

It's important to understand that the challenges and issues faced by P25 and other trunked, digital radio systems are vast, multifaceted and extremely complex. Some of the issues are related to the P25 standards and the standards-setting process, while others have to do with vendors, manufacturers, planning (or lack thereof) by customers and served agencies, user training (or lack thereof), technology and even the laws of physics.

Frustrating and expensive as they are, these aren't simple, cookie-cutter issues, and this article

A technician configures the "back office" central server components of a Harris P25 trunked radio system. Minus a radio or two in the background, it's difficult to tell this setup apart from a typical computer server. (Courtesy: Harris Corporation)

can only address a fraction of the overall factors. If you explore the links in the resources below, however, you will begin to see a much bigger picture. Be prepared to spend hours doing so.

APCO Project 25 in a Nutshell

Project 25 was initiated in 1989, but gained considerable momentum in the post-911 debacle summed up with the question, "Why can't federal, state and local public-safety workers talk to one another on the radio?" The standards, aimed at creating digital public-safety radio systems that are interoperable, backward-compatible with existing analog systems, and spectrum-efficient, are produced by a joint effort of APCO, various federal agencies, numerous equipment manufacturers and the Telecommunications Industry Association (TIA), which publishes the P25 standards.

But P25 is far from "all inclusive." It's a sprawling collection of multiple standards (in six main groups) that govern how P25 radios and radio systems function. P25-compliant systems are being deployed in three main phases.

Phase 1 is where the bulk of existing P25 systems operate on 12.5 kHz-wide channels (digital and legacy/analog). Most Phase 1 standards have been finalized and ratified. Phase 2 hardware adds additional digital modulation technologies to enable advanced features and a much narrower 6.25 kHz-wide channel spacing. Some Phase 2 standards have not yet been finalized. Phase 3 standards will address the public-safety use of high-speed data using wireless broadband networks and will be coordinated in conjunction with an international effort called Project MESA (Mobility for Emergency and Safety Applications). Phase 3 standards are undergoing significant development.

Problems with P25 and Digital Radio Systems

There are fundamental differences between the operational characteristics of analog and digital radio systems – just ask anyone who receives their TV signals off-air. During the recent transition to digital TV broadcasting in the U.S., countless thousands of viewers noticed that they couldn't receive digital signals from stations that were previously watchable in analog, that multipath distortion was the new watchword of the day, and that digital signals were simply there or they weren't. There was no "fringe reception zone" where signals were noisy and degraded, but watchable.

Whether we're talking about P25 or any digital radio system, trunked or otherwise, the physics of digital radio are unavoidable. If a firefighter is stuck in the basement of a building, his chances of making a successful radio call under less-than-optimum conditions are almost certainly better with an analog radio (or a P25 radio switched to analog mode). Many fire companies have come to the same conclusion and are now requiring firefighters to use analog communications at fire scenes, saving the digital radio systems for dispatch and other wide-area connections.

TRACKING INTEROPERABILITY FUNDING

By Ken Reitz KS4ZR

Nearly $1 billion in the form of federal matching grants were made available to state and local governments in 2007 to upgrade their public safety communications. The grants were a result of the 9/11 Act (Implementing Recommendations of the 9/11 Commission Act of 2007). The legislation directed the National Telecommunications and Information Administration (NTIA), the same agency in charge of the DTV transition of 2009, to administer the grants in consultation with the Department of Homeland Security (DHS). Grants were administered through the Public Safety Interoperable Communications Grant Program known as PSIC and required states and territories to fund 20% of the total requested amount.

Recipients of PSIC grants could use their funds for a wide assortment of projects not confined to radios or towers and had until September 30, 2010 to complete their projects, though limited extensions were granted. So, where did the money go? You can find out what programs your state and county had planned to do and the budgets they received through PSIC grants by going to this web site:
www.ntia.doc.gov/psic/awardsmap.html.

The data are complete through September 2008 and examine the status of all state and local enforcement agency preparedness. PSIC awards had a requirement that states and territories (which also qualified for such grants) have an approved Statewide Communications Interoperability Plan (SCIP) and approved Investment Justifications (IJs) prior to release of funds. According to NTIA, all 56 states and territories have SCIP through DHS's Office of Emergency Communications.

What the PSIC awards map doesn't tell is whether or not the installed systems actually work or that taxpayers are getting their money's worth or that these incredibly expensive projects are being properly managed. For that, most Americans have to rely on their local press. But, local information about a particular system may look like an isolated incident. There should be a clearinghouse of information nationwide that could provide a library of such information.

Luckily, there is. That place is a blog written by Daryl Jones, an entrepreneur in the telecommunications field whose work deals with developing advanced technology for public safety, including issues with Project 25 radio systems.

The site **http://blog.tcomeng.com** tracks mainstream media reports on problems associated with digital trunked radio systems across the U.S. You can read the actual newspaper articles that Jones has archived dating back to 2002. Headlines such as this one from September 21, 2010 in *The Oregonian,* "Oregon Emergency Radio System Running Late and $107 million Over Budget," ought to be enough to cause local governments to be humiliated, politicians ashamed and taxpayers ready to revolt.

Daryl Jones also has a running series he calls "The Appearance of Impropriety," in which problems stemming from poor project management to possible outright fraud are documented.

Value engineering:

Technology issues aside, one of the main reasons digital trunked radio systems "fail" is because they're often scaled back to the point where customers can initially afford them. The systems are so expensive – often tens of millions of dollars each – they're frequently "value engineered" to the degree that there isn't sufficient infrastructure to provide adequate coverage.

If a customer needs, say, 37 towers to provide solid coverage system-wide, but can only secure funding for an initial 19-tower system, the whole project is probably doomed from the start. High-power vehicle radios may work fine with fewer towers, but because of "value engineering," in-building communications become problematic, especially with lower-power, handheld radios, and there will be dead spots, even in some outdoor locations. Many systems suffer from these issues.

Inexperienced buyers:

When a customer, say a county, moves to implement a P25 system, administrators are faced with technical and operational challenges they're often unprepared for. They usually lack the necessary technical expertise and must rely on vendors, consultants and manufacturers for just about everything. For many local county-level technical specialists, a P25 digital radio system is the biggest, most complex project they've ever tackled, and it's often technically way over their heads. In reviewing existing "failed" installations, it's clear that some customers had difficulty securing even simple project components such as the rights to necessary tower sites.

Poorly defined functionality:

Many customers – and way too many vendors – don't fully understand or can't precisely define required system and operational features during the planning stage and, because of that, their resulting radio systems may have expensive and unnecessary features, may lack critical functionality or capacity, or simply "don't work the way they should." And when you combine confused customers with overzealous vendors, a

In 1939, the T69-20A UHF mobile transmitter was the first of its type made by Motorola. Crystal-controlled on a single frequency, it put out 10 W of AM between 30 and 40 MHz. (Courtesy: Motorola)

kaleidoscope of "failed" systems, cost overruns and the appearance of general mismanagement ensues.

Operational costs:

Many buyers simply don't plan for ongoing support and maintenance costs and are completely unprepared for apparently hidden costs, such as potentially huge fees for software licensing and other unforeseen or poorly explained expenses. P25 systems are complex, computerized, requiring expert setup with constant tweaking by highly skilled technicians, none of which come cheap (and none of which are likely to already be on county staff).

It's a big computer! P25 systems are essentially big, highly centralized, networked computers. When the server crashes or the power goes out, all communications can instantly fail until the system is restored, unlike mission-critical business computers where servers have redundant backup hardware that can seamlessly "fail over" when one goes down (and are backed by emergency power systems).

Because of ever-pressing cost concerns, many digital radio systems lack redundancy and are vulnerable to power and hardware failures. To avoid those issues, Motorola, Harris and EADS all offer expensive options for redundancy. Even so, in some cases the components that are needed to automatically switch from main to standby systems have caused catastrophic failures. In addition, most systems will revert to site-trunking or "Failsoft" modes if the central controller fails.

Remember, digital radios aren't really radios in the traditional sense – they're computers. P25 manufacturers actually call their digital radios *terminals*, as in computer terminals, because that's exactly what they are. A trunked P25 radio system is a lot like a computer network with a central file server and a bunch of remote client computers, which, in this case, are digital radios (digital radio computers). As such, they are subject to similar problems.

Vocoder problems:

One of P25's core technologies is its vocoder hardware and software that converts speech audio into digital data (and back again), with the goal of saving precious RF bandwidth. Under ideal conditions the P25 vocoder, essentially mid-90s technology, works well enough, but many users find its performance in noisy field conditions completely unacceptable. The problem is that there's no real provision in the P25 standards for using an improved vocoder, because switching core technologies in mid-stream would play greater havoc with interoperability, a major benchmark of P25 in the first place.

Transit time:

Because a trunked P25 digital radio system is essentially a string of networked computers and terminals, audio signals can take a long time to transit the system. When a user presses his PTT switch and speaks into his radio, his voice may take two to five seconds to be heard as speech on the receiving end of the link.

Key-up time:

Gone are the days when a user can simply mash the PTT switch and start talking. Trunked P25 systems are highly centralized, and before a user can speak, the central server has to find an open channel, reserve that channel for the intended users, communicate the channel information to the respective radios, validate encryption keys as necessary, etc, which can sometimes take several seconds. No matter how desperate your situation, if you start talking before the system has provisioned your connection, nobody will hear you!

Loosely-defined standards:

P25 standards aren't fully documented and set in stone. There's plenty of wiggle room for vendors and manufacturers to interpret a standard's "exact meaning" and add "enhancements" that differentiate their products from those of competing manufacturers. These enhancements can indeed add value, but they can also "lock" customers into single-sourced hardware and upgrades, as the "enhanced" hardware, which meets the published P25 spec to the letter, still can't be manufactured by anyone else. A major goal of P25 was to have digital radio systems that could interoperate with each other without regard to manufacturer. And, we still don't have that.

Moving targets:

Most P25 standards beyond Phase 1aren't fully ratified and are under active development, making full compliance difficult or impossible.

Open standards that aren't:

Articles, papers and material from P25 participants over the years promote the concepts of "openness" and "open standards," but P25 standards aren't exactly open in the usual sense. When you get down to brass tacks, the P25 standards-setting process is in fact, vendor driven, with Motorola doing much of the driving. In fact, Motorola, with its roughly 80% share of the public-safety radio market, owns a lot of the

The XG-100M, Harris' newest P25 mobile radio, part of the company's Unity line, incorporates leading-edge, noise-reduction technology. (Courtesy: Harris Corporation)

intellectual property (IP) at the core of P25.

There are processes and practices in place for other P25 participants to license and use this IP in a non-prejudicial manner (one company can't get a better "deal" than another), but there's no provision to allow someone to develop a truly "open-source" implementation of a P25 trunking controller, for example.

So, P25 standards are open in a certain sense, but not open in every sense. Linux, for example, the open-source software that runs most of the Internet, contains IP that's freely licensed and contributed by its developers, but it's truly open in the sense that anyone can produce, publish or manufacture hardware and software based on it, at no cost, without risk of running afoul of someone's IP lawyers.

Cost:

With infrastructure costs soaring into the millions per system, you'd think manufacturers might give away the actual radios as incentives! Until that day, hand-held and mobile P25 trunked radios typically sell for between $3000 and $6000 each, more if you add features such as encryption or dual-band operation.

Obsolescence issues:

Customers may expect more service life from P25 systems than will be provided by manufacturers, not because the hardware will wear out or break down, but because the vendor or manufacturer may simply decide that its hardware or software is obsolete, potentially forcing an expensive and unexpected upgrade. If your P25 trunked system uses features provided by only one manufacturer, meaning that nobody else can provide the required hardware or software to keep your existing system working, that manufacturer may suddenly declare that your system's software is no longer supported and they've decided that you need to replace it with the company's new line of hardware and software, complete with multimillion dollar price tags.

Security vulnerabilities:

Every radio system has certain basic vulnerabilities. If you cut the coax at the base of a tower, for example, that node is off the air. P25 systems have these vulnerabilities, too, but because P25 is essentially a distributed computer system, it can also be attacked as a computer.

Matthew Blaze, a computer security expert and professor at the University of Pennsylvania, wrote a paper, with the help of students and partial funding by a grant from the National Science

Foundation, titled "Security Weaknesses in the APCO Project 25 Two-Way Radio System." In the paper, published November 18, 2010 through the Department of Computer and Information Science at the University of Pennsylvania, Blaze and his team highlighted multiple P25 vulnerabilities, including active traffic analysis attacks, selective jamming attacks, and even distributed denial of service (DDOS) attacks similar to those used on the Internet.

An average shoplifter isn't likely to escape justice by exploiting P25 security flaws, but because P25 systems are widely used by federal, state and military agencies, P25 security is a legitimate issue when it comes to organized crime and terrorists.

A Look to the Future

In the near future, the date January 1, 2013 stands out. On that day, all public-safety radios in the U.S. that operate between 50 and 512 MHz may only transmit signals with a maximum bandwidth of 12.5 kHz (down from the current 25 kHz standard). That includes business radios, taxi cabs, public safety, you name it.

Since 1997, to be sold in the U.S., public-safety radio equipment has had to accommodate 25 kHz or 12.5 kHz transmission bandwidths. Despite the suggestions of some over-eager independent sales firms, the 2013 "narrowband mandate" does not require digital radios: 12.5 kHz narrowband analog FM works just fine and is fully compliant. If you have equipment that was purchased in 1997 or thereafter, you don't even have to buy new gear to comply with the new standard. You simply have to reprogram your existing radios (which can still be quite a process if your system supports hundreds or thousands of users).

Longer-term, over the next two to five years, P25 faces competition from broadband IP network technology that transports digital communications: voice, video, images and data (much like the Internet does now). Whether these IP networks will be common carrier (such as a cell phone company) or private, may depend on who controls the spectrum and who can build the system most economically. Ultimately we may see some of both.

It's ironic that, because the P25 standards process has dragged on for so long and the systems use technology that many see as outdated, P25 digital radio systems may be functionally obsolete before they're seen as actually functional and reliable. That's no consolation for a customer who is $50 million "upside down" in a new P25 trunked system. In the big picture, the expert advice for potential P25 customers should be *caveat emptor*, "Let the buyer beware."

SCANNING P25 DIGITAL SYSTEMS

Scanning enthusiasts have had a roller coaster ride over the past decade or so with regard to successfully scanning P25 and other digital trunked radio systems, but the current crop of P25-capable scanning receivers is making it easier than ever before. Not all of the success has been driven purely by improvements in radio technology. In many ways, up-to-date databases of frequencies and talk groups provided by RadioReference (**www.radioreference.com**) and others have made a big difference in an average user's ability to successfully receive trunked radio communications, P25 and otherwise.

"The FCC," says Paul Opitz, a Senior Product Manager at Uniden, which manufactures several P25-capable scanning radios for its own brand and others, "really only coordinates frequencies, emission types and transmission bandwidths, and doesn't get involved with talk groups and other details that are often crucial to scanner listeners. Until the RadioReference database achieved its present level of maturity, a product such as our HomePatrol-1 receiver was practically impossible."

The HomePatrol-1(see review in October 2010 *MT*) incorporates licensed data from the RadioReference database, allowing users to simply enter their location information (ZIP code or GPS) and let the radio set up frequencies and talk groups for local radio systems based on the database, eliminating or greatly reducing the need to ferret out the information for a specific location and program the radio manually.

The HP-1 is the first receiver Opitz has worked on that was specifically targeted for consumers' ease of use. The rest, he says, have feature sets driven mostly by the needs of professional users who, surprisingly, buy a significant number of P25-capable scanners.

"When federal and state agencies send personnel into unfamiliar jurisdictions," says Opitz, despite the promise of P25 standards, "they're not set up to automatically interoperate with local and state public safety agencies everywhere they go. To at least monitor most trunked, digital communications, the 'three letter agencies' could send along a pile of $10,000 service monitors, or they could send along a bunch of $500 P25 scanners, which do pretty much the same thing at a fraction of the cost."

A similar situation exists on a more local level. Police and public-safety helicopters, for example, are frequently loaned out to other jurisdictions. And if a helicopter is following a police chase across four counties, the airborne personnel won't automatically have radio communications with every municipality, county and agency they could encounter. By incorporating a P25 scanner, as many do, they have a fighting chance of knowing what's heading their way.

According to Opitz, not many police officers listen to scanners while off duty, but plenty of firefighters and first responders do. "That's why a lot of the features in our P25 scanners are based on input from professional users. There are an awful lot of Uniden scanners being used in the field on a daily basis."

Encryption and a smattering of proprietary digital radio systems can make reception challenging for enthusiasts and professionals alike. Most federal P25 systems are encrypted, as are a handful of big-city systems (many of which are being replaced and updated with newer, more "standard" P25 systems). The forums at **www.radioreference.com** contain a treasure trove of information about scanning specific systems. You can also find discussions about the societal and governmental issues surrounding encryption and the impact of closed public-safety radio systems on the public's "right to know."

- Kirk Kleinschmidt NT0Z
Photo Credits: Uniden

READING LIST AND RESOURCES

http://apcointl.org – The APCO International main web site.

http://blog.tcomeng.com – A web blog by Daryl Jones, a veteran public-safety radio technology consultant, that contains links to hundreds of articles and resources on P25, problems with digital radio systems, mainstream media hits, interoperability issues, technology and government, and more.

www.dvsinc.com/prj25.htm – DVSI develops P25 vocoder technologies.

www.openp25.org – The web home of an open-source P25-compliant switch and trunking controller project.

http://openp25.org/wp-content/uploads/2008/03/p25trainingguide.pdf – An online copy of P25 Radio Systems Training Guide by Pete Lunness of Daniels Electronics (Canada, **www.danelec.com**).

www.project25.org – The Project 25 Interest Group web site.

www.radioreference.com – a radio communication database that lists public-safety frequencies, specific information about trunked radio systems nationwide, and plenty of informative forums on these topics and more.

http://tiaonline.org – The Telecommunications Industry Association main site.

About the author: Kirk Kleinschmidt NT0Z is a regular contributor to MT and writes the On the Ham Bands column, also found in this issue. His last feature, "MT's Guide to Buying a Transceiver," was part of the November 2010 MT Radio Buyer's Guide.

The Newspaper of the Air: *Early experiments with radio facsimile*

By John Schneider W9FGH
Photos courtesy of the Detroit News Archives

In the early 1930s, radio was the newspaper's worst enemy. Radio competed for advertising dollars and offered a free news alternative to a cost-conscious public during the depression years. It also offered an immediacy that was not possible for newspapers, and which publishers feared could undermine their business. The result was a war waged by newspaper interests against radio that attempted to keep stations from broadcasting the news.

The wire services at first boycotted radio completely, and then set up the Press Radio Bureau that was designed to give broadcasters limited amounts of news service in a format that would not compete with newspapers. Some stations, particularly WOR in New York, revolted against the control of the news by the established newspaper interests and banded together to form their own news service called Transradio News.

Despite a host of legal challenges, Transradio not only survived but thrived, and the newspapers' monopoly on the news had been broken. This resulted in an about-face strategy by the newspapers that began to buy up radio stations in major cities around the country under the strategy of "if you can't beat 'em, join 'em." Soon there were major newspaper-owned stations all over the country: in Chicago, Detroit, Cleveland, St. Louis, Sacramento, San Francisco and elsewhere.

The next obvious step was for the newspaper owners to find a way to "synergize" their new newspaper-radio combinations. One of the answers they found lie in the new technology called Radio Facsimile.

Early Radio Facsimile Efforts

Radio facsimile had the potential of becoming the "dream application" for newspaper-owned radio stations. It would allow them to transmit news bulletins to their subscribers overnight via the airwaves, generating additional subscription and advertising revenue. It also had the potential to eliminate the costly newspaper printing and delivery process completely, allowing the delivery of news to subscribers via radio at little or no cost. It could also shift the distribution cost from the publisher to the consumer, if the latter could be convinced to purchase his own facsimile printer. These motives and other factors resulted in a flurry of experimental radio facsimile activity on radio stations around the country in the latter part of the 1930s.

The process of facsimile by wire had been around for a long time before it was applied to radio. The first fax patent, issued in Paris in 1843, used a swinging pendulum to draw the image. Edwin Belin demonstrated his Belinograph in 1913. Western Union and AT&T both transmitted photos via wire in the early 1920s, and the technology was quickly accepted by the press as a way to send newspaper photos instantly to cities around the country.

RCA was the first company to send a transoceanic image via radio, transmitting a photograph of President Calvin Coolidge from New York to London on November 29, 1924. Two years later, RCA began sending transoceanic photos by shortwave radio as a commercial service for the newspaper industry. The company also transmitted weather maps to ships at sea.

Their patented "Photoradio" technology was invented by RCA scientists Richard H. Ranger and Charles J. Young. The system used a rotating drum and a photoelectric scanner to convert a document into a continuous tone that varied in pitch with changes in the image. The image was reproduced on the receiving end with another rotating drum having a stylus that pressed black carbon paper against white paper to reproduce the image.

A few radio broadcasters showed early interest in adapting the technology to broadcast pictures to the public. KPO in San Francisco, owned by the San Francisco *Chronicle*, was the first radio broadcaster to transmit a photograph by radio, when it transmitted a picture of cartoon character Andy Gump on August 22, 1925. The image was signed by *Chronicle* publisher George T. Cameron with the message "Radio's latest wonder-pictures through the air. What new marvels will this science bring forth?" The image was received on a single machine invented by C. Francis Jenkins.

Some other early radio broadcasters who experimented with the transmission of images via AM broadcasting were KSD, owned by the St. Louis *Post-Dispatch*, WTMJ, the Milwaukee *Journal* station, and WOR in Newark. In fact, KSD had conducted experiments with facsimile transmission over phone lines as early as 1923. WOR was using the Cooley-Ray Foto System developed by Austin Cooley to transmit images late at night. Experimenters could build their own Cooley-Ray receivers by modifying an old phonograph.

William Finch Markets the Radio Facsimile

But, the person who really brought radio facsimile into the public's eye was William G. H. Finch. Born in England in 1897, Finch moved to the U.S. in 1906, where he studied electrical engineering and radio communications at Columbia University and the University of Cincinnati, before going to work for the Hearst Family's International News Service (INS). While at the

Radio-Newspaper Receiver for Home Use

DESIGNED to fit the top of a commercial table receiver which it matches in cabinet style, a complete radio-newspaper receiver for home use has just been placed on the market. All necessary apparatus for receiving and printing news bulletins and pictures transmitted over the air are contained in the unit. The news is automatically printed on a continuous sheet of paper that unwinds from a roll as it is received. The instrument can be used in conjunction with any radio receiver, the manufacturer declares, provided it has an output of at least five watts.

Anyone can now own one of these home-model, radio-newspaper receivers

From Popular Science, May, 1939



INS, he set up the first radio teletype circuits between New York, Chicago and Havana.

Working for the INS, he developed an interest in facsimile machines, and his experiments led to a portfolio of patents that eventually numbered in the hundreds. In 1935 he established his own company, Finch Telecommunications Laboratories, to build and market his system.

Unlike RCA, which had concentrated on the commercial applications of its technology, Finch's vision was the delivery of newspapers to the general public via radio facsimile. The Finch system got around the RCA patents in a number of ways. First, the image details were transmitted by varying the amplitude of an audio tone instead of its frequency. Secondly, it recreated the image by generating an electric current at the tip of a stylus that traced the image onto thermally sensitive paper.

The Finch scanning head used an electric light bulb, lens, and photocell to create a pinpoint scanning spot. A motor moved the scanning head across the page, and another motor advanced the page at the end of each scanning line. The voltage created by the photocell varied the intensity of a high frequency tone; low frequency sync pulses were inserted to signal the end of each line. The result was an audio signal that could be fed into any conventional AM transmitter. Reception and transmission were synchronized using the 60 cycle AC power frequency.

The Finch receiver was housed in a one-foot square wooden box, and it could be connected to the speaker of any radio receiver having at least 3 Watts of audio output. The speaker needed to be turned off and the receiver volume adjusted to get the proper contrast on the image. It recreated the images on a continuous, five-inch wide strip of thermal paper. A roll of paper sold for one dollar and would last a week under normal use.

An electric motor moved the writing stylus slowly back and forth across the paper, generating an electric current that corresponded to the image. The current burned off the orange or white coating on the paper, allowing the black surface underneath to show through. Another motor advanced the paper slightly when it received a sync pulse, preparing the paper for the next scan line. (Finch was the first to use the thermal paper technology that was eventually used in early FAX machines and continues to be used today to print cash register receipts.)

The transmission process was slow, requiring about 20 minutes to print each 12 inch page. However, the consumer could set up a timer on his receiver to capture the overnight transmissions from a local AM station during overnight hours when there were no normal radio broadcasts. Six hours overnight was enough time to deliver a six page two column news bulletin in time for breakfast.

The First FCC Regulations of Radio Facsimile

The first radio tests of the Finch system took place in 1933 over W10XDF, transmitting from the Teterboro Airport in New Jersey. By 1937 Finch had developed his technology into a practical radio facsimile system and was able to convince several radio stations to begin regular use of the technology. The participating AM stations transmitted their radio newspapers overnight to a small number of Finch receivers in the homes of consumers who participated in the experiment. Each station was required to purchase 50 receivers at $125 each, the equivalent of $1,900 per receiver in today's money.

In September of 1937, the FCC authorized the first radio stations to broadcast the facsimile service on an experimental basis, provided that no advertising or other revenues were generated from the experiments. The first broadcast of printed news via radio was made on October 15, 1937 over KSTP in St. Paul, Minnesota. WGH in Newport News, Virginia and WHO in Des Moines, Iowa, also participated in the early testing.

The Finch technology was demonstrated to radio broadcasters at the NAB convention in Washington in February of 1938, where a daily convention news report prepared by the editors of *Broadcasting Magazine* was broadcast. By March of that year, Mutual's WOR in New York was also conducting experiments with the Finch equipment, and 2,000 amateur radio operators witnessed a demonstration of the system from WOR at a hamfest in Newark, New Jersey in April.

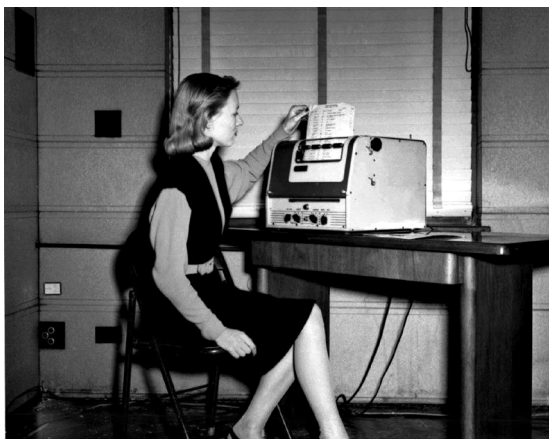
First Regular Facsimile Newspaper Broadcast

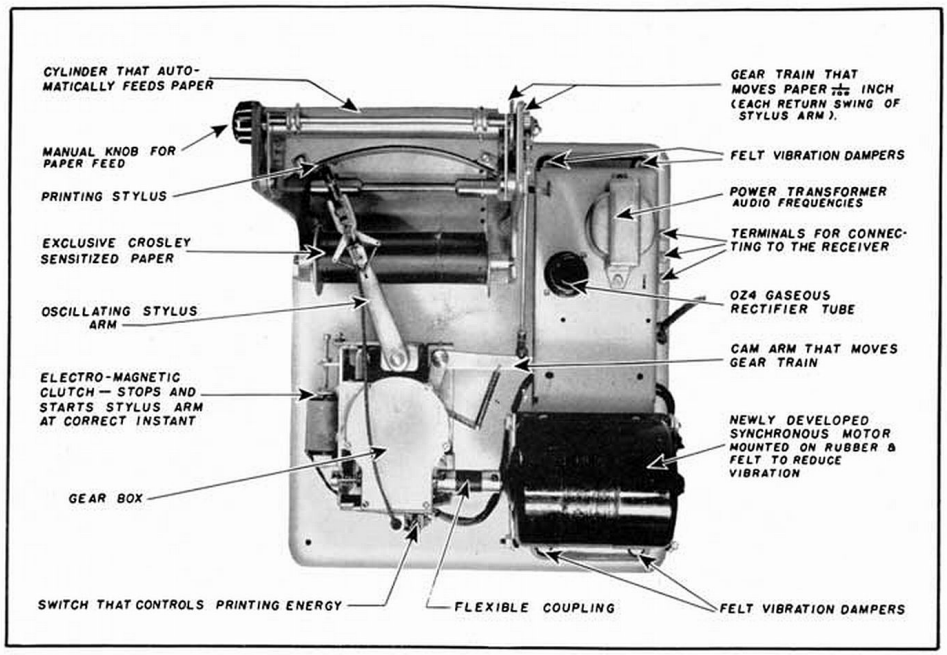
Meanwhile, RCA had become aware of the sudden success of the Finch system. They had been the originators of radio facsimile technology, but had never considered its usefulness in terms of transmission to the general public. Determined not to be left behind, they quickly repackaged their commercial system into a format suitable for the public and in 1937 convinced the St. Louis *Post-Dispatch* to test it on their station KSD. While initial transmissions were made overnight on KSD, by December of the following year they had moved the service to an experimental ultra-high frequency station W9XZY, which was constructed in St. Louis with RCA's help. The station transmitted with 100 Watts on 31.6 MHz and had a range of about 20 miles. Daily transmissions of the radio newspaper using the RCA system were begun in February of 1939.

There were several reasons for using a dedicated transmitter for facsimile. For one thing, the transmissions need not be limited to overnight hours and the *Post-Dispatch* broadcasts were now being made daily at 2:00 p.m.. Second, the ultra-high frequencies were less susceptible to radio static, which greatly disrupted the received image quality.

Fifteen receivers were provided by RCA for the experiment and were placed at Washington University and in homes around the St. Louis area. The receivers, which were offered to the public for $260 each (a staggering $4,100 today), combined an ultra-high frequency receiver and teleprinter into a single cabinet that offered no controls or adjustments. The user simply kept the receiver supplied with rolls of carbon paper and white printing paper, which passed over the revolving metal cylinder that contained the printing stylus. A metal bar which moved with the printing signal's intensity varied the pressure on the stylus to create the image.

The W9XZY radio newspaper consisted of 9 pages, 8-1/2 inches long and four columns wide, printed in 7-point newspaper type. It featured news articles of the day, sports news, photographs, an editorial cartoon, a daily radio





schedule and radio gossip column as well as a page of financial news with stock market prices. It took about 2 hours to transmit a full issue of the paper. Like the Finch system, it came out in a continuous strip that could be cut or folded for convenient reading.

Other Stations Join the Fray

In October of 1937, the FCC gave permission to WGH in Newport News, Virginia, and WHO Des Moines, Iowa to experiment with facsimile broadcasts over their regular medium wave frequencies from midnight to 6a.m.. Both stations would use the Finch system.

In 1938 in California, the McClatchy Newspapers published the "Radio Bee" which was broadcast over its stations; KFBK in Sacramento and KMJ in Fresno. McClatchy had a staff of seven to produce the radio newspaper, mostly technicians. McClatchy bought 100 Finch receivers and distributed them to listeners in central California. Unfortunately, the McClatchy service only lasted a year.

In 1938 Finch facsimile signals also began emanating from WGN in Chicago, WHK in Cleveland, WSM in Nashville and WWJ in Detroit (The Detroit News). In 1939 W2XBF New York began regular service for three hours a day. Mutual Network stations WOR New York, WGN Chicago and WLW Cincinnati all began facsimile transmissions the same year using Finch equipment. In addition to creating their own local news content, the three stations traded material among themselves for use by all stations.

At first stations worked with their newspaper owners or other local newspapers to provide the "radio printed" news. The exceptions were WHO and WGN, who used Transradio News Service as their news source. The Transradio Press Service also announced plans to build 25 stations around the country, feeding news prepared in New York. Transradio president Herbert Moore said the present newspaper "is four times too big and four times too expensive to operate." There is no indication that the stations were actually built, however.

By 1939, nine AM stations were broadcasting a daily facsimile service: KFBK, Sacramento; KMJ, Fresno; WBEN, Buffalo; WGN, Chicago; WHK, Cleveland; WHO, Des Moines; WLW, Cincinnati; WOR, Newark, and WSM, Nashville. All stations transmitted their news bulletins between midnight and 6 a.m..

But the preferred method of operation was increasingly shifting from overnight AM broadcasting to the use of dedicated shortwave and ultra shortwave facsimile stations. In 1938, the FCC had allocated 2012, 2016, 2096 kHz exclusively for facsimile broadcasting – but rescinded the allocations the following year and replaced them with channels at 25, 43 and 116 MHz. In 1939, two thirds of the facsimile stations on the air were operating on the ultra high frequencies and the FCC had received no new requests for overnight transmission on the AM band.

Among the first stations to be assigned were two licensed to the Milwaukee *Journal* (the owners of WTMJ). W9XAF operated with 500 Watts on 41 MHz, and W9XAG had 1,000 Watts on 1,614, 2,398, 3,492.5, 4,797.5, 6,425 and 8,655 kHz. In New York, Radio Pictures, Inc., had a 1,000 watt license for W2XR (the predecessor of WQXR) on 1,614, 2,012 and 2,398 kHz and from 86 to 400 MHz.

In 1939, a number of experimental stations were authorized to operate on a new group of frequencies: 38.6, 31.6, 35.6, and 41.0 MHz. The stations assigned to those channels included W8XTY, 150 Watts, The Detroit *News* (WWJ); W9XZY, 100 Watts, The St. Louis *Post Dispatch* (KSD); W8XE, Radio Air Service Corp (WHK) Cleveland, 50 Watts; W8XUF, Sparks-Withington Co., Jackson, Michigan, 100 Watts; W9XSP, the Star Times Publishing Co., St. Louis; W1XMX, The Yankee Network, Sargent's Purchase, New Hampshire (Mt. Washington), 500 Watts. Also, the W.G.H. Finch Laboratories in New York had a "special experimental license" for W2XBF, which operated with 1000 Watts on 38.60 and 41.00 MHz.

In 1939, RCA chose the occasion of the New York World's Fair to promote its radio facsimile technology. It enlisted WOR to make daily transmissions, using the RCA system, which were picked up for the public to see in the main hall of the RCA pavilion at the fair. WOR also transmitted daily publicity pieces from a major motion picture studio on its 710 kHz frequency after 1:30 a.m. using its "Radioprint" system. In addition, WOR transmitted to the fair with the Finch system from 2 to 4 p.m. daily over its shortwave station W2XUP on 25.7 MHz with 100 watts.

RCA also cooperated with the New York *Herald-Tribune* to produce the "Radio Press," an 8-1/2" x 12" newspaper that was transmitted by wire within the confines of the RCA pavilion building. It used RCA's high-speed facsimile technology that could deliver a complete page every minute. RCA predicted that every home would soon have a facsimile receiver. Of course, advertising sales were expected to cover all the costs of the service itself when it became authorized for commercial operation.

Crosley Enters the Facsimile Field

RCA was promoting its home facsimile receiver at the 1939 Fair for $260 (roughly $4,000 in current dollars). But before the end of the fair, Crosley would surprise everyone by announcing a new facsimile product called the Reado. Its two models would sell for $60 and $80. A timer to turn the unit on and off over night was sold separately for $10, and a kit version of the facsimile printer was available to experimenters for $50.

The Crosley station WLW in Cincinnati had been one of the early experimenters with the Finch facsimile system, and its patriarch Powel Crosley Jr. had become fascinated with the business potential of the technology. Crosley, sometimes call the "Henry Ford of radio," had always been a master at producing low-cost products. His inexpensive radio receivers in the 1920s had brought radio to millions of listeners who could not have otherwise afforded it.

Applying the same formula to radio facsimile, he licensed the Finch technology, made some improvements to lower the cost, and started producing his own low-cost facsimile printer. He produced an initial stock of 500 units, and set up manufacturing in the factory to turn out up to 1,000 units a day. A Crosley Reado brochure released in 1940 predicted a bright future for radio facsimile that eerily presaged the multi-cast future of today's broadcasting:

"The art of transmitting pictures and other printed material by radio will advance. Nothing shall hamper its growth. Pictures of world events, cartoons, comic strips, news flashes, weather maps, market reports, everything of a visual nature will soon be coming over the air. It is not anticipated that facsimile will directly compete with the newspapers. It will unquestionably be and continue to be a source of flash news rather than detailed mass printed material which can only be supplied by the newspapers and periodicals. Facsimile does not directly compete with sound broadcasting. On a separate channel, it will unquestionably be available as an augmenting service, providing a visual record of material other than music and sound being produced for your perusal whether you are present or absent."

WLW transmitted its facsimile news

service with its half-million watt output in the early mornings up until the first year of World War II. The Reado newspapers were also read on the air every morning.

The Public's Lack of Interest

Despite all the promotion and hype, radio facsimile was a technology that the public never asked for and didn't care about. Facsimile printers were an expensive luxury for most people at the tail end of the depression, while newspapers were cheap and delivered to your door each day. In addition, stations and publishers could not interest many advertisers in supporting a new medium, as they preferred the security of the traditional newspaper.

The technology was also not without its problems. One of those was static, which was more disruptive to facsimile than to sound broadcasting; a short burst of static could wipe out a page or more of text. Operation on the high frequencies was designed to solve this problem, as the high band was less susceptible to static interruption. It also allowed stations to operate during the day and had a wider bandwidth which made faster transmission speeds possible. But the tradeoff, compared to high powered AM radio, was the signal range, which was typically limited to a radius of 30 to 50 miles.

The consumer of the 1930s was not prepared to have such a complicated appliance in the home. Paper jams or the failure to change a paper roll resulted in missed service. There were speaker switches, timers and volume controls to be set. Consumers also complained that the transmission was too slow and the paper size too small.

Then there was the problem of the two competing standards: RCA and Finch. Broadcasters and consumers were reluctant to invest in equipment for fear of choosing the wrong system. (Similar standard battles have hampered the development of other technologies in more recent years. Consider the experience with AM Stereo, the VHS/Betamax battle and most recently, the HD DVD/Blue-Ray standard fight.)

Finally, established interests were afraid of the new technology's potential to upset the established order of the newspaper business. Would radio facsimile be an adjunct to the newspaper, or did it have the potential of replacing the newspaper? Yes, it could be delivered for lower cost, but it offered less space for news and advertising. Would it open the door to new competitors? In theory, anyone could get into the radio newspaper business without the required large investments in printing presses and delivery trucks that kept most people out of the newspaper business. Billions of dollars of machinery investments could become obsolete overnight. The unions predicted that 150,000 men would lose their jobs in newspaper print shops alone if the radio facsimile replaced the newspaper.

Radio facsimile was also competing with other new technologies for the public's attention. By 1940, there were already a number of FM stations on the air as well as the first experimental television stations. Those technologies excited the public much more than facsimile, which ended up lost in the shuffle. As a result of these and other issues, many stations had already discontinued their facsimile services by the end of 1940, and the start of World War II saw what was left of the service come to an unceremonious end. By 1943 there were only three facsimile stations still on the air in the country: W9XWT in Louisville, W8XUM in Columbus and W2XWE in Albany.

Post-War Activity

After the end of the war, there was an effort by some to revive the radio facsimile concept. William Finch still believed in facsimile as a mass medium. He proposed the idea of delivering the news directly to consumers over telephone lines as a subscription service, but could never get the idea off the ground. In 1947, he demonstrated a colored facsimile system that used colored pencils mounted on four different rotating drums to create an image, a technology that was featured in a *Popular Science* article in November, 1947.

There was renewed experimentation for a while with radio facsimile broadcasts over early FM stations. The greater bandwidth of the FM signal allowed four pages of information to be transmitted in 15 minutes. WFIL-FM, which belonged to the Philadelphia *Inquirer*, transmitted twelve pages of news each day. WQXR and WGHF in New York and WENA in Detroit also made regular facsimile news broadcasts. Major Edwin Armstrong, the inventor of wideband FM, was demonstrating that facsimile could be transmitted over FM subcarriers. Tests of the method were conducted for a time by WIOD-FM in Miami, which was owned by the Cox newspaper group.

Meanwhile, the FCC was now seeing facsimile as a parallel technology to television, the delivery of images by radio. It tried to regulate both under the heading of the "visual broadcast service." In 1945, when the FCC moved all FM broadcasters to the new 88-108 MHz band, it reserved 88-92 MHz for noncommercial broadcasting and 106-108 MHz for radio facsimile. In 1948, the Commission held hearings on selecting a proposed standard for facsimile broadcasting and finally adopted rules and standards for doing so on the FM band. But no new FM facsimile stations were ever built and the FCC eventually reassigned the 106-108 MHz sub-band for FM audio broadcasting.

It's obvious now that the FCC was about ten years behind the curve in its efforts to regulate and commercialize radio facsimile. Television was now the darling technology, FM radio was relegated to a back seat position for many years, and radio facsimile simply came to a technological dead end. William Finch's company went into bankruptcy in 1952 and RCA eventually took over many of his patents. Finch died in Florida in 1990 at the age of 93.

Radio facsimile, of course, continued to exist as a specialized commercial technology and is still used today for the transmission of weather maps by satellite and a dwindling number of shortwave services. Xerox found success leasing its Telecopier machines to businesses in the 1970s, allowing them to send documents across the country or around the world over ordinary phone lines. An improved digital version of this device turned into the fax machine boom of the 1980s and '90s.

Today, it's extremely rare to find an old 1930s facsimile machine in the hands of collectors, as so few of them were actually made. The surviving Crosley Reado machines were popular with ham radio operators in the 1950s, and many of them were modified for the reception of weather maps sent by shortwave to ships at sea. Those collectors lucky enough to have one now are the owners of a curious and short-lived bit of radio history that is all but forgotten today.

About the author: John Schneider W9FGH is a regular contributor whose last feature was "The Short Life of Ultra Shortwave" which appeared in the December 2010 issue.

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Buying and Selling on eBay: Notes for the Novice

By Bob Grove W8JHD
(Photos courtesy the author)

The global expansion of an on-line marketplace is an irresistible temptation to a growing number of bargain hunters and entrepreneurial sellers. With the prolonged period of economic decline, millions of financially distressed businesses and financially threatened individuals have turned to the number one Internet auction house, eBay.

There is no question that electronic shopping, coupled with a poor economy, has had a devastating impact on "brick and mortar" stores. It has also been brutal on hamfests, flea markets, yard sales, thrift shops, and live auctions. I know – I'm a licensed auctioneer (another of my endless stream of hobbies!).

Just a few years ago, advertising an auction containing guns and tools would bring hundreds of willing bidders. My last auction of guns and tools, advertised and promoted in radio spots, newspaper ads, an illuminated sign, a mail-out to our mailing list, and our auction website, brought in only seven bidders!

Even so, many folks are reluctant to try on-line auctions for a number of reasons; unfamiliarity with auction procedures, horror stories about scams, and distrust of dealing with so many unknowns to name a few.

The "Electro Ion-A-Meter," is a classic example of collectible quackery.

Over more than a decade, I've sold thousands of items on eBay. Since I live in a rural area with minimal shopping opportunities, I've also bought quite a few items on line. Have I ever been scammed? Yes. But it's very rare, and I've minimized it by taking precautions.

Always keep in mind that eBay is its own commercial enterprise with its own set of rules and regulations. State and federal laws that govern live auctions do not apply on line, nor do they provide protection except from criminal fraud. Then you have legal recourse, but if you make a final bid and the seller changes his/her mind, or doesn't follow and acceptable protocol, or is late sending merchandise, or doesn't answer email, or other infractions of good auction behavior, there's nothing you can do except register negative feedback. But don't be too hasty; once you send feedback, you can't retract it.

Bidding and Buying

There are no surcharges for bidding and buying on eBay, only for selling. As a buyer, you only owe what the seller charges, including shipping. Some offer free shipping but mark up the selling price to cover the expense.

The selling price may be set several ways. The seller will indicate a starting price, and the bid increments are set by the eBay auction program, from a few cents to several dollars, depending on the current price.

The seller may optionally set a "Buy Now" price, a retail value that if you're willing to pay, you'll win the auction immediately. Alternatively, he may consider an offer below his Buy Now price. My experience is that exercising the Buy Now option happens most often on inexpensive items and less often on the high ticket ones.

Most auctions are of the traditional format: A small opening bid is given, and you enter the highest price you would be willing to pay for the item. The seller never sees this; the eBay program simply enters a small, incremental bid for you each time someone else's bid exceeds yours. If someone else's bid exceeds your highest registered amount, you can re-enter a higher top bid.

Most auctions last a seven-day week. You never have to look at the auction item again unless you're curious about how the bids are going – which you will be! When the auction closes, you will be notified by email whether you won or lost.

Can I Trust the Seller?

Over the years, eBay has established some stiff regulations. One of these involves a "feedback" system which automatically displays the number of satisfaction comments a seller has received from his buyers, and whether they are positive or negative. Details of these comments are also available.

Obviously, a seller who has completed hundreds, or even thousands of auctions, and maintains a very high positive rating (perhaps 98%-100%) should be considered trustworthy.

Return policies, shipping instructions, contact information and other details about the seller are also available.

If you are dissatisfied with the transaction and feel that an item was misrepresented, improperly shipped, or any other legitimate claim, and you have been unsuccessful in resolving it with the seller, you may contact eBay to establish a case.

Selling

You say you have an old radio that you would like to turn into cash? If it's a modern clock radio, forget it. Don't bother trying to sell anything that's readily available elsewhere unless your price is much lower.

How do you know whether or not you'll have competition? Simply type a brief description into the search line. Typing "Scanner" will certainly give you a head start, but as I write this, I see that there are more than 31,000 sellers listing "Scanner." But these may be computer scanners, office scanners, barcode scanners, and even under radio scanners they could be portable, mobile, base, hand-held, crystal, Uniden, GRE, and so on.

Therein lies a tale. Be specific when you list an item. "Scanner" isn't enough. eBay gives you room for 55 characters and spaces. If you type "Uniden BCD396T hand-held portable digital scanner" you will snag prospective buyers looking for that particular model, or a hand-held portable, or strictly a Uniden, and so on. It refers

Uniden HomePatrol-1 Digital Radio Scanner

Simple Programming - Simply enter your zip code or city, and HomePatrol-1 selects the channels in use in your area.

TrunkTracker IV (Motorola APCO 25 Digital, Motorola, EDACS, LTR) - Lets you monitor all of the major types of communications systems used by public safety, local government, amateur radio operators, and more.

S.A.M.E. Emergency/Weather Alert - Allows you to specify the area that you need to hear any alerts that may be Weather, Civil, Biological, Nuclear, or National in nature.

Covers US and Canada - The built-in database includes all known channels in use in the United States and Canada. (Some services not available in all areas.)

Quick Record and Playback - Lets you record sessions for later playback or archiving.

Instant Replay - Lets you replay the most recent reception with a single tap.

3.5" Daylight Viewable Display

Free Radio System Updates - Radio System database is updated weekly.

No Subscription Needed.

Touchscreen Operation - Makes it easy to control what you are hearing.

HomePatrol Sentinel PC Software Included - Lets you update the HomePatrol-1's database, update firmware, and more easily manage favorites lists and other settings in your HomePatrol-1.

HomePatrol-1 lets you quickly hear the communications systems used by Public Safety, Aircraft, Military, Weather Spotters and more. Simply enter your US Zip code or Canadian Postal Code and HomePatrol-1 does the rest. Whether it is across town or across the street, HomePatrol-1 keeps you informed.

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Faradic batteries were all the rage in the late 1800s. Shocking!

more sales prospects to your listing, and they will see fewer competitors.

When you first open your auction, you will be asked to select a category. Type in two or three descriptive words that nail it down (Uniden BCD396T scanner, for example). eBay will then automatically present you with a list of possible categories from which you can choose one or more. You will be charged according to the number of categories in which you've chosen your listing to appear.

Can I Trust the Buyer?

As a seller it's possible to have trouble collecting money from buyers, but it's rare. I've found it's less than 2-3% if you don't count those that you have to dog to death to get their money! It's important to check the feedback record and rating of the buyer when you are selling and the seller whey you are buying. A feedback of 95% or more is generally quite safe, especially if the person has been a registered user for a long time and has sold a great deal of merchandise. My feedback is 100% and I've sold over 1,000 items. And, if you have had trouble with a particular individual you can use your filters to build in their identification so as not to accept their bids.

So What Will it Cost Me?

There are several factors which determine the cost of listing an item on eBay, including starting bid (insertion fee) or reserve price, classification(s), upgrades (highlight your item), final selling price, length of auction, when you list, number of pictures, promotional features, etc. eBay also has specialty sites for automotive and real estate.

For auction-style listings like yours and mine, fees for starting bids of $10 to $200 and up are $.50 - $2. When the item sells, a final value fee of 9% is added (maximum fee $50).

If you have a fixed price on an electronics item (no auction), the final value fee is 8%. This is the lowest rate on the eBay fee schedule. If you sell books, DVDs, movies, music, or video games, the fee is nearly doubled – 15%!

Still, compared to live auctions at an auction barn, eBay is less expensive and has a far bigger crowd. The down side, of course, is that you can't personally examine the merchandise before the auction, you don't know the auctioneer or the seller, and you can't take it home with you when you win it!

Shipping Issues

Once you've sold your item you'll need to be able to ship it. I prefer to use UPS whenever possible. Their personal service is first rate, their tracking is right on time, and their rates are reasonable. We don't use FedEx (which also provides excellent service) because of our Grove Enterprises UPS volume discount unless a customer asks for it. I try not to use the U.S. Postal Service because they lose packages, don't track accurately, and have no customer service.

Is There a Better Time to Sell?

It's been said that the best time to list an item for sale is during the weekend when folks are likely to have a computer accessible to search eBay and to watch the final part of an auction. Frankly, I haven't had that experience.

The critical parts to having a successful auction is to list an item in demand that is in good condition, describe it well, and provide good photography for the bidder to see. For a collectible radio, that means the front, the back, and the inside. And be sure you have it listed in the appropriate category(ies). A Hammarlund receiver listed under tropical fruit punch probably won't get many hits!

Showing the item in its original packing encourages a bid.

The Waiting Game

Watching the bids during your listing week can be frustrating, even all-consuming of your spare time. Did I list the starting price too high? Too low? How many people have visited my listing? Are they checking back? Has anyone bid yet? I know – I'm a nervous seller!

Today, as I write this article, I've just finished a week's listing for nine items. Six sold, so I feel that it was a successful venture. Let's take a look at what I listed, how many hits (visits) I had to my listing, how many non-bidders continued to watch my sale through the week, what sold, and what didn't.

- POLARISCOPE FOR GEM STONE CRYSTAL IDENTIFICATION: 25 hits, 1 watcher, sold $5.20
- TWO ULTIMETER WPIX3 NUMERIC DISPLAYS: 7 hits, 1 watcher, sold $4.95 (Only bid)
- 300 WATT VHF/UHF DUMMY LOAD, 36 hits, 4 watchers, sold $32.00
- DUAL BAND 144/440 MHz SWR/WATTMETER 18 hits, 1 watcher, sold $29.00 (Only bid)
- 14" SNARE DRUM WITH REMO HEADS 63 hits, 2 watchers, $29.00 (Only bid)
- JENSEN CAR STEREO AMPLIFIER 45 hits, 0 watchers, $9.95 (Only bid)
- VHF PAGER FILTER (153 MHz) 23 hits, 2 watchers, (No sale)
- VHF PAGER FILTER (158 MHz), 22 hits, 2 watchers, (No sale)
- UHF PAGER FILTER (462 MHz), 30 hits, 2 watchers, (No sale)

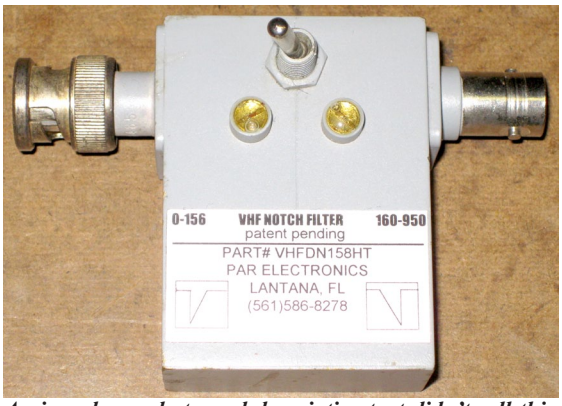
So what's to learn from this week's sale? While a large number of visitors and watchers is a good sign, it's not a guarantee. A recent sale I had showed over 100 visitors and nearly 40 watchers, yet no one even opened with a bid!

Don't be discouraged if you don't see bidding early in your week. Seasoned eBayers don't show their cards; they wait until the last minute – literally!

This is called "sniping," and it's legitimate. They assume that not everyone will be ready at the close, so they invoke automated software applications that cascade their competitive bids in the closing seconds to prevent manual response from other, slower bidders! Sneaky, huh?

What are They Looking For?

Everyone likes a bargain, so price is important. List low; if enough people want your item, they will outbid each other. If you initially list too high, you will limit the bids. Psychologically, the more bidders you have, the more likely you can have a bidders' war!



A nice, sharp photo and descriptive text didn't sell this filter.

If you attend a farm sale, you'd likely be looking for farm equipment. At an office sale, you're there for office furniture and supplies. But on eBay, all bets are off; some of the most amazing stuff turns up in every imaginable category.

But there are some descriptions that are not allowed, like firearms, fireworks, prescription drugs and machines, mercury, out-of-band CB radios, cruel animal traps, pornographic imagery, and others.

So what does sell well? Let's confine our list to the electronics hobby. Nearly anything reminiscent of vintage electronics sells well. This includes famous brands like Heathkit, Hallicrafters, National, Hammarlund, Lafayette, RCA, and EICO.

Antique radios are also in high demand among collectors and restorers. Don't throw away that Zenith or Philco just because you can't find tubes for it!

But parts and accessories like vacuum tubes, carbon microphones, knife switches, large panel meters, air-variable capacitors, and other small items associated with early radio are in demand. Quack medical machines like violet ray devices and Faradic batteries are hot.

Don't overlook modern or even current brands like ICOM, Yaesu, Drake, JRC, AOR, Kenwood, Alinco, WiNRADiO, Ten-Tec, and Perseus. Hams have a voracious appetite for equipment and constantly scan eBay for bargains.

The Business of Online Selling

Can a person quit his day job and make a living selling on eBay? Well, if he already owns a home, doesn't own a car, and doesn't eat! eBay is an excellent avenue for making money to pay for frivolities or that extra gear that you feel guilty paying for with family money. But, you have to be very careful. Remember, you have a worldwide audience looking for a bargain and thus bidding against you and they also have things to sell, thus marketing competitively.

And, you do have to consider your own time and expenses and put a value on those when considering selling more than the occasional radio online. I'm very experienced, yet I suspect that photographing, writing text, filling out the ad template and submitting variables for each new item (time to start, length of auction, stating price, shipping charges, credits or charitable donations, etc.) it's takes me about 15-30 minutes of work. Of course, if you have repetitious ads, you can simply resubmit your previous template.

The Bottom Line

On-line auctions are an artifact of our time; they are growing and are here to stay. With proper precautions, you can be a wise buyer and a wise seller. Always remember, however, that you have virtually no recourse if a sale or a purchase goes bad other than contacting eBay and notifying them of the dispute. eBay will then attempt to contact the other party to mediate the dialog. In the end, everything still depends upon the integrity of the parties to reach a resolution. I must congratulate a business the size of eBay that takes great measures to protect its clients, both buyers and sellers. Visit their security center for advice on avoiding fraud: **http://pages.ebay.com/securitycenter/avoiding_fraud.html**

With conventional buying from established businesses, such as those who have advertised for years in *MT*, you have a sure thing. On line you win some, you lose some. But, by taking proper precautions on line, just as you would in assessing the reputation of a brick and mortar business, you can cut your losses. Over the long run, and with the exceptions understood, the major on-line auctions are reputable.

MT

SCANNING REPORT

THE WORLD ABOVE 30MHZ

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www.signalharbor.com

Operating the Pro-106/PSR-500

It's a general principle of technology that things start out simple and get more complex with each successive generation. Scanners are no exception. This month we address an operational question for a late model scanner and clarify some terminology from a previous column.

❖ Minden Parish, Louisiana

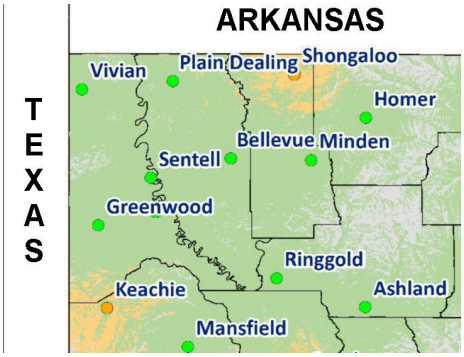
Dan,

I have a problem with my Pro-106 digital scanner. I'm a newcomer. I sent the scanner to a programming company in Ohio. After getting it back, it was set to operate (scan) on the conventional frequency. The trunking system is programmed in also. I do not know how to change the scanner to the trunking system.

I am located in Minden, Louisiana. The state police and three northern parishes were installed. I would appreciate any assistance that you can provide to help with this problem.

Woodrow in Louisiana

Minden is a town of about 13,000 residents in northwest Louisiana, located 30 miles east of Shreveport. It is the seat of Webster Parish and covers an area roughly 12 miles square. Webster Parish is located in Louisiana's Homeland Security Region 7, in the northwest corner of the state.



The town and Parish public safety agencies operate on a number of conventional frequencies that Woodrow's scanner should be covering now.

Frequency	Description
145.430	Minden Skywarn
153.965	Minden Police (Tactical)
154.055	Sheriff
154.115	Minden Police (Dispatch)
154.250	Fire Protection District 3 (Dispatch)
154.265	Fireground and Mutual Aid B
154.280	Fireground and Mutual Aid A
154.295	Fireground and Mutual Aid C
155.235	Advanced Ambulance (Dispatch)
155.415	Sheriff (Dispatch)
155.685	Camp Minden Louisiana National Guard Fire
158.820	Webster Parish Emergency Operations
158.880	Sheriff
463.950	North Webster Medical Services (Dispatch)

In addition to the local frequencies, the State operates a trunked radio system called the Louisiana Wireless Information Network (LWIN). The system supports more than 56,000 users from about 120 repeater sites and is now active in every Parish in the State.

As the nation learned in 2005, Louisiana is home to a great deal of critical infrastructure related to oil and natural gas processing and delivery, including a hub that connects nine major interstate pipelines. The Federal Emergency Management Agency (FEMA) paid nearly $16 million to Motorola for the repair and enhancement of radio infrastructure in the area affected by Hurricane Katrina, including 19 LWIN repeater sites in southeast Louisiana. Over the past five years, the State has spent more than $122 million on LWIN repeater sites, backhaul links, radio equipment and related costs. Individual agencies have spent an additional $126 million on mobile and portable radios. More money will be spent in the future as additional jurisdictions and agencies join the system.

❖ Scanning LWIN

From a technical perspective, LWIN is a "pure" Project 25 (P25) system, meaning that it is completely digital and uses the Project 25 standard control channel and trunking protocol. It operates in both the 700 MHz and 800 MHz bands, so you will need a scanner capable of trunking properly in the 700 MHz band. Current models that have this capability are:

Make	Model
GRE	PSR-500, PSR-600
Radio Shack	PRO-106, PRO-197
Uniden	BCD396T, BCD396XT, BCD996T, BCD996XT

❖ Control Channel Scanning

All of these scanners are also capable of operating in a "control channel only" mode, where the only frequencies that must be programmed are the control channels. By listening to the messages being sent on the outbound control channel, the scanner can determine the correct voice frequency to monitor.

The control channels in operation in the Minden area are listed below. If a second channel is listed, it means both a primary and an alternate frequency have been monitored; program both frequencies into your scanner.

Location	Site ID	Control Channel(s)
Bellevue	23	768.65625, 769.18125
Greenwood	13	769.94375
Homer		28 769.20625
Mansfield	31	769.19375
Minden		10 770.19375
Plain Dealing	36	769.21875, 769.46875
Ringgold	37	769.08125, 769.65625
Sentell		38 774.84375
Shreveport	41	769.15625, 769.40625

The following is a list of talkgroups that may be active in northwest Louisiana. Talkgroup identifiers may be represented in either decimal (base-10) or hexadecimal (base-16) notation.

Decimal	Hex	Description
5120	1400	State Police Troop G (Dispatch 1)
5121	1401	State Police Troop G (Dispatch 2)
5122	1402	State Police Troop G (Tactical 6)
5124	1404	State Police Troop G (Car-to-Car)
5126	1406	State Police Troop G (Narcotics)
5130	140A	State Police Troop G (Tactical 1)
5131	140B	State Police Troop G (Tactical 2)
5132	140C	State Police Troop G (Tactical 3)
5133	140D	State Police Troop G (Tactical 4)
5134	140E	State Police Troop G (Tactical 5)
5136	1410	State Police Troop G (Tactical 7)
5181	143D	Department of Public Safety 1
5182	143E	Department of Public Safety 2
5183	143F	Department of Public Safety 3
5188	1444	Department of Public Safety (Police 1)
5189	1445	Department of Public Safety (Police 2)
5190	1446	Department of Public Safety (Police 3)
6078	17BE	Wildlife and Fisheries Region 7 (Dispatch)
6079	17BF	Wildlife and Fisheries Region 7 (Patrol)
6080	17C0	Wildlife and Fisheries Region 7 (Tactical)
11004	2AFC	Claiborne Parish Sheriff (Dispatch)
13500	34BC	Bossier Parish Sheriff (Car-to-Car)
13522	34D2	Bossier Parish Sheriff (Dispatch)
13523	34D3	Bossier Parish Sheriff (Records)
41564	A25C	Bienville Parish (Coordination 1)
41565	A25D	Bienville Parish (Coordination 2)
41566	A25E	Bienville Parish (Coordination 3)

41567	A25F	Bienville Parish (Coordination 4)
41776	A330	Webster Parish (Coordination 1)
41777	A331	Webster Parish (Coordination 2)
41778	A332	Webster Parish (Coordination 3)
41779	A333	Webster Parish (Coordination 4)
41826	A362	Troop G Region 7 (Alerts)
41827	A363	Troop G Region 7 (Tactical)
41828	A364	Troop G Region 7 (Calling)
41829	A365	Troop G Region 7 (Coordination 1)
41830	A366	Troop G Region 7 (Coordination 2)

❖ Radio Shack PRO-106

The PRO-106 is a handheld scanner built by GRE America and sold through Radio Shack. Introduced in October 2007, it is nearly identical to the GRE-branded PSR-500 and comes with a number of advanced features including "Signal Stalker II" (find nearby transmissions automatically), object-oriented memory management (replaces the old bank-and-channel storage scheme), and a temperature-compensated oscillator to keep the scanner precisely on the correct frequency. It also offers scanning and trunking in the new 300 MHz and 700 MHz bands.

With so many features, capabilities and options, programming the PRO-106 and other object-oriented scanners can be a challenge, so Woodrow's choice to use a third-party service for that task is certainly understandable.

❖ PRO-106 Scanning

The PRO-106 has a number of modes and features, but if there are objects already programmed into it, just press the [SCAN] button to start the scanning process. You will see the display showing five lines. In the center of the top line is a signal strength indicator. The second line from the top will show the word "Scanning." The next two lines are the scan lists that indicate which lists are currently enabled.

In order for the PRO-106 to actually scan the objects mapped to a scan list you must enable the list. There are twenty regular scan lists that you can enable and disable. While scanning, you can press the digit keys [1] through [0] to enable and disable scan lists 1 through 10. Press [FUNC] followed by the digit keys [1] through [0] to enable and disable scan lists 11 through 20. When enabled, the scan list number will appear on the display. When the scan list number is disabled, the scan list display will show a dot. When you press the digit key, the bottom line of the display will report the scan list number that you are toggling.

So, the first step for Woodrow is to make sure that the appropriate scan lists are enabled. He can do this by enabling all 20 scan lists and then disabling those lists that don't have interesting or relevant frequencies. Some scan lists may also be empty – the number will blink if you enable a list that has no objects mapped to it.

The scanner will remember the scan list selections between power cycles, so nothing will be lost when it is turned off.

❖ PRO-106 Analyze

The nearest repeater site for LWIN appears to be near Minden using a control channel on 770.19375 MHz. You can manually confirm that you are receiving this channel by having the PRO-106 "analyze" the programmed trunking system.

To see the system information in "Analyze" mode, press the [PGM] key, then [F2] (Edit). Press the right arrow key until the word "TSYS" appears above one of the three softkeys ([F1], [F2] or [F3]). When it does, press the softkey that corresponds to "TSYS". Use the up and down arrows to scroll through the list of programmed systems. This will give you an idea what systems the shop in Ohio set up in your scanner.

When you get to the system you want to analyze, press the [MAN] button, then press [F3] (Analyze). At this point the fourth line should show a channel number and the corresponding frequency.

Use the up and down arrows to view each of the programmed channels. As you move up and down the list, the scanner will tune to the frequency shown on the display. If the channel is active, you should hear something from the scanner. If it's a control channel, you'll hear the buzzing sound of a digital data channel. For Woodrow, if the display shows 770.19375 and there is buzzing, it means the proper frequency is programmed into the scanner.

If you have a sufficiently good "decoding quality" from your location, you should be able to hear the LWIN activity transmitted from your local tower.

❖ More PRO-106 Information

As with most scanners, there are many sources of information for the PRO-106 on the Internet:

- The Radio Shack PRO-106 interest group can be found at **http://groups.yahoo.com/group/RadioShackPRO-106/** The group has nearly 1,000 members and is fairly active.
- There is a similar group, called RS PRO-106, that can be found at **http://groups.yahoo.com/group/RSPro-106/** and reports having more than 600 members.
- If you have a fast Internet connection you might also want to search **www.youtube.com** with the term "PRO-106" to find user-submitted videos featuring programming and operating demonstrations of the scanner.
- There is an "easier to read" manual

for the PRO-106 (and the functionally equivalent PRO-197, PSR-500 and PSR-600 models) at **http://marksscanners.com/106_197/106_197.shtml** that may help illuminate some of the more obscure or unclear passages in the factory *User's Guide*.

❖ VIPER Clarification

Dan,

First off, you do a wonderful job with the Scanning Report column in Monitoring Times each and every month. Thanks for giving both new and advanced radio geeks a great resource for information.

In the September 2010 Scanning Report, you answered a question from Kevin in South Carolina about the VIPER system here in North Carolina. In the column you stated that VIPER operates in Simulcast mode. Well, leave it up to our government to create a confusing situation; part of VIPER does operate in Simulcast mode, but the majority of the system operates in SmartZone mode. Let me try to explain.

When the system was in its infancy back in the 1999-2000 time frame, the capital of North Carolina was chosen as the "heart" of the system. That would be the City of Raleigh, which is in Wake County. Since we were the guinea pigs back in the early days we got special "perks." One of those perks was that the Wake County part of VIPER was set up in a Simulcast format, while the rest of the system was built out in a SmartZone format. System users notice no difference at all and can freely roam between the SmartZone part of VIPER and the Wake County Simulcast part.

For us radio geeks this means that if you are monitoring In Wake County you only need to add the Simulcast control channel frequencies of 868.7875 and 868.5625 MHz, while anywhere else in North Carolina you need to add the frequencies of the site to which you are closest.

I am not trying to nitpick but just wanted to hopefully make a confusing situation a little clearer. I really do appreciate all of the hard work you put into your columns each month.

Marshall in North Carolina

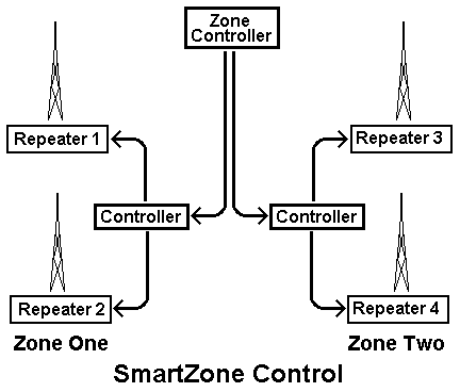
Simulcast is short for "simultaneous broadcast." A simulcast system has two or more repeater sites that are all transmitting the same signals on the same frequencies at the same time. Each repeater site is synchronized to a common time signal, typically via the Global Positioning System (GPS), which is commonly used to determine location but also provides very accurate time.

The main reason for using simulcast is to provide maximum coverage in a geographic area. Blockages and shadowing from hills or mountainous terrain can be overcome by adding additional repeater sites in advantageous locations and configuring them to transmit identical information. Because the same signal is on the same frequency from multiple repeater sites, the mobile or portable radio can maintain communication when moving from one site's coverage area to another without having to take any action. Any member of an active talkgroup located anywhere in the service area can participate in the conversation, since the conversation will be carried by every repeater site. To the radio, the system appears as if it is a single repeater site with a very wide service area.

The downside of simulcast is the inefficient use of frequencies, severely limiting the amount of activity the system can handle. Since the frequencies and signals are the same across the entire service area, the system can only support as many conversations as there are available frequencies to use. A conversation occurring through just one repeater site ties up one of those frequencies, making it unavailable for any other conversation, even if that second conversation could be handled through a different repeater site.

❖ SmartZone

SmartZone is a marketing term that describes a family of products sold by Motorola. Generally speaking, a SmartZone system is made up of individual zones, where each of those zones is either a single repeater site or a network of multiple sites. Zones with more than one repeater site may or may not be simulcast. Repeater sites in non-simulcast zones operate independently and transmit on different frequencies.



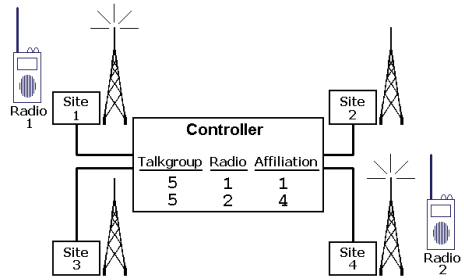
SmartZone systems have the ability to use available frequencies more efficiently than a plain simulcast system. Rather than transmit a conversation through every repeater site, a SmartZone controller can transmit a conversation only through the repeater sites that serve participating radios. For instance, imagine a four-site system with two radios active in a talkgroup. One radio is in the coverage area of repeater site 1 and the other radio is in the coverage area of repeater site 4. In this situation the controller does not need to transmit that conversation from repeater sites 2 and 3, leaving them free to serve other talkgroups.

The system controller keeps track of which radios are in within the coverage area of each repeater site through a process called *affiliation*. When a radio comes within range of a repeater site, it sends a message to the controller on the inbound control channel that includes the talkgroup selected by the user. The controller maintains a table of what talkgroups are affiliated with each repeater site. When a talkgroup is active, the controller uses that table to identify which repeater sites need to transmit the conversation.

❖ Roaming

Affiliation is similar to the way your cellular telephone operates. When you turn on your phone it begins listening for a radio signal from nearby cell sites. When it finds a good signal, it transmits a *registration* message, letting the cellular system know that you're available to receive a call. The system keeps track of your phone number and the cell site that your phone can hear. When you move to another cell site, your phone sends another registration message in order to keep the cellular system updated as to your whereabouts.

When someone calls your phone number, the cellular system looks for the last cell site you registered with and sends out a *paging* message via that cell site. Your phone will receive the paging message and alert you to answer the phone and start a conversation.



If you move far enough that you leave your "home" network and enter a different network, called a host, your phone will keep sending registration messages to the nearest cell site, but the host network will recognize you as a "roamer" rather than a direct customer. Via an interconnection network, the host system will inform your home system that you are roaming and that you are reachable via the host system.

Trunking systems also have the concept of roaming. Portable and mobile radios have a "home" system to which they normally belong. This home system may be part of a larger radio network. When a radio moves outside of its normal operating area, it can affiliate with a host system as long as the host system can interoperate with the home system. This is the basic idea for a SmartZone system – to allow radios from one zone to roam into other zones and still function normally.

Roaming also applies to much larger trunked systems, including state-wide networks. For instance, SmartZone systems can be connected together to form an OmniLink network. Radios from one SmartZone can roam to other SmartZones within the overall OmniLink network. This affiliation causes talkgroup conversations to be carried in multiple SmartZone systems.

That's all for this month. More information related to scanning and trunked radio operation is available on my web site at **www.signalharbor.com.** I welcome your questions, comments and frequency lists via electronic mail to *danveeneman@monitoringtimes.com*. Until next time, happy scanning!

ASK BOB

GENERAL QUESTIONS RELATED TO RADIO

Bob Grove, W8JHD
bobgrove@monitoringtimes.com

Q. *Automotive battery charger instructions say to connect the red (positive) wire to the battery + terminal, then connect the black (negative) wire to the chassis, not the battery's negative terminal, to prevent any spark which might ignite the hydrogen gas near the battery vents. Wouldn't it be just as safe to simply not plug in or turn on the charger before connecting both wires to the battery terminals? (Mark Burns, Terre Haute, IN)*

A. It would seem so, but what if there were a short in the wires or charger, or some residual voltage in the charger, or you had merely thought it wasn't turned on? By avoiding that second connection to the battery terminal, there's no way a spark could occur next to a vent.

Q. *I operate 40 meter CW and our net is often interrupted by a "swish" sound as a carrier glides through our frequency. This is repeated periodically. What is this signal? (Mike, KK2DOG)*

A. Ionosondes (frequency sweepers) originate from government agencies (or their contractors) for the most part – NOAA, USN, etc. – and are most commonly sent in pairs or triplets, but certainly can be singles as well.

They are used to determine maximum usable frequencies (MUFs) to intercommunicate among various stations on the earth's surface. They can travel over most any width of spectrum, from a few kilohertz to several megahertz.

Using the waterfall spectrum display now found on the better digital receivers, you can readily see their diagonal traces overlaid in sharp contrast on the vertical traces made by frequency-stable signals.

Q. *I'm thinking of mounting a Grove Scanner Beam and a Scantenna in parallel for improved reception. Is this a good or a bad idea? (Mark Miller, Heppner, OR)*

A. When a signal arrives obliquely to such an array, one antenna is farther from the signal than the other, and the signal strengths may either add or subtract, depending on the wavelength and the angle of arrival due to phase differences when they combine.

If you can rotate it, that may work, canceling signals in some directions and at some frequencies – all unpredictably, especially since they are different in design.

Even so, in the directions that they are adding their signals properly (in phase), the maximum gain would be only 3 dB, but when they cancel, they completely null out the signal.

Arrays are always done using identical antennas for predictability, and usually over a narrow band of frequencies. Even then, they are very directional with deep nulls off the sides.

Q. *If I erect an inverted L antenna running 30 feet up, then 45 feet horizontally, will it pick up signals from all directions? (Ben Nye, Westbury, NY)*

A. Yes, but because it's not entirely vertical, there will be some frequencies where there will be some signal cancellation from certain directions. The horizontal section will be directional off the sides, and phase differences between the upper and lower sections will produce some signal nulls from certain directions.

But the non-uniformity will be most apparent on the higher frequencies because of the shorter wavelengths, and since the higher part of the shortwave band is not always predictable due to the solar influences, you will probably be listening to the lower frequencies most of the time, so the antenna will be very suitable for reception in all directions for the majority of your listening.

Q. *Now that CW is no longer required for an amateur radio license, why isn't SSB allowed on the 30 meter band? (Wilbert R. Warke, N9RGE, Lebanon, IL)*

A. The 30 meter band is authorized by the International Telecommunications Union (ITU) and modes are mandated by the World Administrative Radio Council (WARC) which holds its plenipotentiary meetings only every few years to discuss amateur radio considerations.

When WARC finally released its privileges for the 30 meter band, only narrow-band technology was allowed because the band itself is very narrow, providing maximum international usage only to narrow-band modes. It is used worldwide by amateurs on a shared basis with narrow-band fixed services.

Q. *When I hook an outdoor discone to my hand-held scanner, it has poor reception, but the antenna works fine when connected to my desktop scanner. What might be the problem? (Mike Faraguna, Sunrise, FL)*

A. Since most scanners have virtually identical reception, then:

1. The adapter you're using with the hand-held is not making a good connection, either because of misalignment of the center conductor or the center hole in the antenna connector of the hand-held has been flared out to where it's not connecting to the antenna cable connector.
2. Some local signal is so strong that it's overloading the hand-held, causing desensitization.
3. The hand-held has lost sensitivity; compare the two scanners with their attachable whips to see if there's a significant difference in weak-signal reception.

Q. *Why would anyone buy a larger desktop scanner when the Uniden HomePatrol has so many features? And why would anyone buy one of those hand-held, scanning receivers from AOR, Yaesu, ICOM, or Alinco when they don't have trunk tracking or P25 decoding? (Mark Irish, email)*

A. We might compare the smaller HomePatrol versus a desktop scanner to the difference between an iPAD and a home PC. They may both provide all the functions you need, but the desktop scanners are more substantial and have larger knobs, including the tuning dial, as well as a larger, more informative readout.

The primary appeal of the HomePatrol besides its compact, lightweight portability is its self-loading capability in mobile applications. There are subtle variances that might be more appealing. It is also the easiest to program, especially for trunking systems.

Wide-frequency-coverage scanners are designed for their spectrum and mode flexibility, not special-system monitoring. Folks who want shortwave coverage along with VHF/UHF land mobile listening have no alternative, at least for now.

Questions or tips sent to Ask Bob, c/o MT are printed in this column as space permits. Mail your questions along with a self-addressed stamped envelope in care of MT, or e-mail to bobgrove@monitoringtimes.com. (Please include your name and address.)

UTILITY WORLD

HF COMMUNICATIONS

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http://mt-utility.blogspot.com

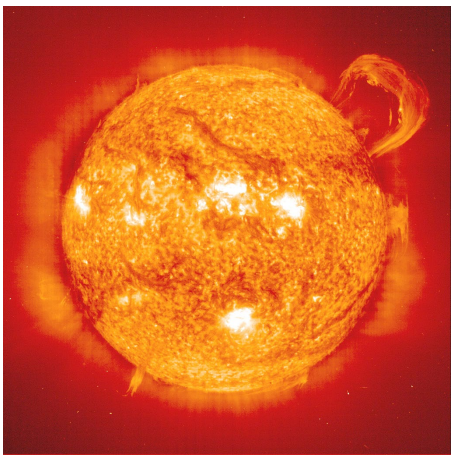
What's Up with Solar Cycle 24?

We're finally in a place where numbers can be crunched, curves can be smoothed, and something quantitative can be said about our much-maligned solar Cycle 24, as they number these things. We can finally say that *what's up* is the solar activity.

One might remember the extended solar minimum, which bottomed in 2008, and its extended lousy radio propagation. This launched a thousand theories. Were sunspots obsolete? Was the sun's internal magnetic dynamo failing? Were we entering another long "Maunder Minimum," with no sunspots at all, as observed in the 1600s?

This discussion has continued. Unfortunately, it has been absorbed into the politics of "global climate change," and often the science of forecasting long-term radio conditions gets lost. Finally, though, we see objective evidence that Cycle 24 is indeed well underway. In fact, it's right about where it should be.

The cycle is still right on schedule for the 2009 consensus prediction of a low, broad peak around late 2012 or early 2013. The smoothed sunspot numbers are still expected to top out somewhere around 90, and the smoothed, corrected, 10.7 centimeter radio flux may peak in the region of 140.



While these figures are not all that exciting compared to the past few solar cycles, they could be much worse. Everyone has been spoiled by relatively high peaks, and there's broad agreement that it's time for some low cycles. While a Maunder Minimum is unlikely, there's a lot of agreement that a Dalton Minimum is overdue.

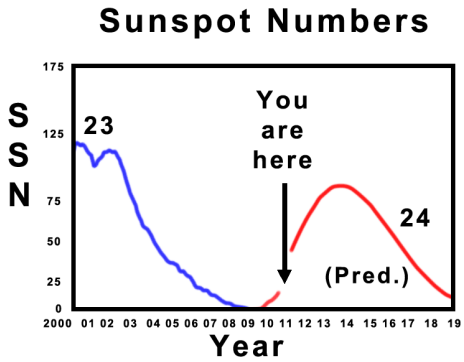
The Dalton Minimum refers to three low cycles after 1800, which followed an extended lull similar to that of 2008. Various theories propose a kind of solar super-cycle, which alternates repeated high peaks with repeated low ones. Proposed causes go all the way from planetary alignments to magnetic changes inside the sun.

Be that as it may, the first cycle of the Dalton Minimum was much lower than what has been predicted here for Cycle 24. On the high frequency (HF) band between 3 and 30 megahertz (MHz), these numbers would give us 4-5 years of perfectly decent radio conditions.

There's something worth remembering about HF radio propagation. It's like fishing. No matter how good it gets, it's never good enough. However, the numbers tell us that it's going to get better on the frequencies above 12 MHz, and a lot better on those above 20 MHz. Fix your antenna and get ready for some fun.

The Numbers

We're radio people here, and a good part of radio involves measuring things so, let's look at some measurements.



First is what are called "spotless days." This does not refer to a utility fan's significant other's opinion of the radio area's cleanliness relative to the rest of the house. While this can indeed be a very important issue, we're actually referring to days upon which no visual sunspots can be found by the various worldwide volunteer observers. In 2009, there were 260 such days, or 71 per cent of the whole year. In 2010, to date in mid-December, there have been only 45.

Second is the solar radio flux. This measures a certain type of excited hydrogen emission that increases with visible activity. It's taken daily at local noon by a Canadian observatory, and is broadcast hourly on WWV.

This daily flux is corrected later on for the earth's orbit, but the changes are not huge. It almost never goes below 60 solar flux units (SFU), even on spotless days. 65 can be considered as a quiet sun baseline.

For most of 2008 and half of 2009, we were pretty much stuck right around that 65-70 level. Late 2010 was much better, with a smoothed average closer to 80. The WWV fluxes now approach 90 on a satisfying number of days. As far as really audible improvement on the HF bands is concerned, this is knocking on heaven's door.

If the steep rise continues (and there's no reason to believe it shouldn't), 100 is not far off. This bodes well for HF conditions in late 2011.

Of course, there are other variables, such as geomagnetic index, to consider when rating a solar cycle for radio. Cycle 23's peak wasn't actually as great for propagation as its impressive numbers would suggest. It was great for watching aurora, but attendant magnetic storming often degraded HF for weeks at a stretch.

And so, make an offering to the propagation gods. Watch the lovely, if somewhat scary, images of giant solar eruptions coming from the new Solar Dynamics Observatory. Meanwhile, let's stop worrying and get back to radio.

WebSDR Update

One of the pitfalls of publishing with a two month lead time is that Internet resources can easily change in the interim. In this case, the link given in December's column for the Web-based Software Defined Radio (WebSDR) stopped working in early November of 2010. This abrupt disappearance was completely unforeseen, even by the site's operators.

The WebSDR is a project of the amateur radio club at the University of Twente, in the Netherlands. It is still very much alive, but the equipment is down. This was caused by the electrical engineering department's move to another building, forcing the club to obtain a new room. They have one, with an Internet connection, but as of this column's December deadline time, the antennas were still not installed.

The club will update the situation at the SDR's usual link, which is still **websdr.ewi.utwente.nl:8901/** . The WebSDR is definitely coming back.

Thailand Radiofax Lives!

This might come as old news to a lot of people, but not to everyone. It's obvious that confusion still reigns in the status of the Bangkok, Thailand weather fax from HSW64. Some will swear that it's off the air, and that anyone saying otherwise is misinformed.

Well, no one told Bangkok Meteorological Radio that. It has kept transmitting, despite all rumors to the contrary.

Listening on the Hong Kong GlobalTuner

radio has confirmed that the Thai radiofax is still broadcast on one frequency: 7396.9 kilohertz (kHz) upper sideband (USB). Your radio dial will read somewhere close to 7395 kHz when properly tuned.

This confusion is caused by slow update, or no update, of data published by national and international agencies. Old lists show five frequencies for Bangkok, all of which are off-air as of 2009. The US list, put out by the National Oceanic and Atmospheric Administration (NOAA), is newer, and has the correct information, though it's presented in a confusing manner. It's at **www.nws.noaa.gov/om/marine/rfax.pdf** .

USB radios always tune shortwave radiofax 1.9 kHz below the listed channel frequency. Computer software displays usually have marks that allow centering of the resulting frequency-modulated audio tone between 1500 hertz (black) and 2300 (peak white). Granted, this can be somewhat more difficult if a weather satellite picture is being sent, and most of the signal is in the middle.

You'll see the numbers 120/576 next to most fax listings. These are settings for this mode's two variable parameters.

The 120 is the lines per minute (LPM). Nearly everything is sent at this rate. A few complex text documents, notably Japanese newspapers, are sent at 60 LPM, which sounds quite a bit different. There are a few other rates used mostly by old Russian machines, which are seldom heard any more.

The 576 number is for the index of cooperation (IOC). IOC is kind of technical, relating to the use of drum scanning in the original machines. Just leave it at 576.

HSW's transmitter power is listed as 3000 watts. This is not a lot for a continuous, analog mode like fax, especially from a single station. Coverage is obviously not as wide as, say, Kyodo News, whose two or three sites can rule the Pacific on a good day. However, the fax is there.

Happy decoding, and see you next month.

ABBREVIATIONS USED IN THIS COLUMN

AFB..... Air Force Base
ALE ..... Automatic Link Establishment
AM..... Amplitude Modulation
ARQ..... Automatic Repeat reQuest teleprinting
BOM..... Australian Bureau of Meteorology
CAMSLANT ..... USCG Communications Area Master Station, Atlantic
CW..... On-off keyed "Continuous Wave" Morse telegraphy
DHFCS..... UK Defence High Frequency Communications Service
DSC..... Digital Selective Calling
E06..... Russian numbers in English, weird computer voice
E10..... Israeli female phonetic voice, 5-letter groups
EAM..... Emergency Action Message
EOC ..... Emergency Operations Center
FAX..... Radiofacsimile
HFDL ..... High-Frequency Data Link
HF-GCS ..... High-Frequency Global Communication System
LDOC ..... Long-Distance Operational Control
LSB ..... Lower Sideband
M08a..... Cuban CW, cut to ANDUWRIGMT, 3-message format
M22..... Withdrawn ENIGMA designator for 4XZ, Israel
MARS..... US Military Auxiliary Radio System
MCW ..... Modulated CW (on-off or AM)
MFA..... Ministry of Foreign Affairs
NAT ..... North Atlantic oceanic air control, families A-F
NAVTEX..... Navigational Telex
NDB..... Non-Directional Beacon
RACES..... US Radio Amateur Civil Emergency Service
RTTY ..... Radio Teletype
Selcal..... Selective Calling
SESEF..... Shipboard Electronics Systems Evaluation Facility
SITOR..... Simplex Telex Over Radio, modes A & B
UK..... United Kingdom
Unid ..... Unidentified
US ..... United States
USAF..... US Air Force
USCG ..... US Coast Guard
V02a..... Cuban "Atencion" female, 3-message format
VOLMET..... Aviation weather broadcasts ("Flying Weather").

All transmissions are USB (upper sideband) unless otherwise indicated. All frequencies are in kHz (kilohertz) and all times are UTC (Coordinated Universal Time). "Numbers" stations have their ENIGMA (European Numbers Information Gathering and Monitoring Association) designators in ().

216.0 CLB-NDB, Wilmington-Carolina Beach, NC, MCW identifier at 0105 (Prez-MD).
363.0 RNB-NDB, Millville-Rainbow, NJ, MCW at 0413 (Prez-MD).
410.4 3YVE-Norwegian multi-purpose vessel Rem Vision, CW heli-deck beacon in Montrose Harbor, Scotland, at 0325 (ALF-Germany).
502.4 G3XIZ-UK 600-meter experimental station, Biggleswade, working PA0DML, CW at 1955 (ALF-Germany).
506.0 LA3EQ-Norwegian experimental station, Egersund, CW identifier and beacon tone, at 1850 (ALF-Germany).
1650.0 Unid-CROSS (French search and rescue), Gris-Nez, weather in French, at 1937 (PPA-Netherlands).
1656.0 Unid-Chipiona Radio, Spain, weather at 2106 (PPA-Netherlands).
1888.0 IPD-Civitavecchia Radio, Italy, voice-synthesized weather in Italian at 2147 (PPA-Netherlands).
2182.0 Unid-Den Helder Rescue, Holland, working rescue vessel Vos Tracker (A8MN8), at 2123 (PPA-Netherlands).
2187.5 002734419-Astrakhan Radio, Russia, calling 273427960, Russian cargo ship Flestina-1, DSC at 2121 (PPA-Netherlands).
2415.0 ARC51-American Red Cross, unknown location, ALE sounding; also on 2411, 2419, 2422, 2439, 2463, 2466, 2471, 2477, 3201, and 6858; at 2355 (Jack Metcalfe-KY).
2585.0 NRV-USCG, Apra, Guam, CW identifier in ARQ marker, at 1611 (MPJ-UK).
2600.0 IQQ-Mazara del Vallo Radio, Italy, voice-synthesized weather in Italian, at 2149 (PPA-Netherlands).
2632.0 IQH-Naples Radio, Italy, weather in Italian at 2151 (PPA-Netherlands).
2642.0 ICB-Genova Radio, Italy, weather in Italian at 2152 (PPA-Netherlands).
2657.0 Lisboa Marine-Lisbon, Portugal, maritime information in English and Portuguese, at 2118 (Lacroix-France).
2663.0 IPC-Crotone Radio, Italy, weather in Italian at 2153 (PPA-Netherlands).
2673.0 ZHEL-German Customs Cruiser Helgoland (DBQL), working ZLST, Customs Control Post, Cuxhaven, at 2256 (MPJ-UK).
2705.0 XJH-UK military, calling XSS (DHFCS control, Forest Moor), ALE at 2002 (PPA-Netherlands).
2760.0 R26329-US military helicopter, calling BROOK in ALE and voice, at 0008 (Metcalfe-KY).
2789.0 IDF-Messina Radio, Italy, weather in Italian at 2154 (PPA-Netherlands).
3150.0 ART-Israeli Phonetic Station (E10), weak 5-group message at 0302 (Ary Boender-Netherlands).
3170.0 KNNP491WV-American Red Cross, WV, calling ARCLA, Louisiana, ALE at 2302 (Metcalfe-KY).
3270.0 ULX-E10, 41-group message at1732. ULX, 12-group message at 2002 (Boender-Netherlands).
3415.0 ART2-E10 null-message format, parallel 5435, at 0202 (Boender-Netherlands).
3924.0 Kinloss-Kinloss Rescue, Scotland, calling "3-M-J," at 1722 (Lacroix-France).
4137.0 Unid-Informal maritime mobile net in Japanese, similar on 8228 and 8817, at 0204 (Prez-MD).
4151.0 Unid-Two maritime mobile males, Arabic chatter at 0107 (Prez-MD).
4177.0 Unid-Two maritime mobile males discussing soccer in Portuguese, at 0415 (Prez-MD).
4207.5 003669991-USCG, Boston, answering DSC call from 309702000, Bahamian flag bulker Lynx (C6OG9), at 0637 (PPA-Netherlands).
4209.5 XVG-Haiphong Radio, Viet Nam, SITOR-B Navtex in Vietnamese, at 1940 (PPA-Netherlands).
4235.0 NMF-USCG, Boston (remoted to CAMSLANT), fax weather chart at 0856 (Lacroix-France).
4270.0 PCD-E10, 20-group message at 2100 (Boender-Netherlands).
4330.0 4XZ-Israeli Navy, Haifa, CW coded message (ex-M22), at 0130 (Prez-MD).
4369.0 WLO-ShipCom/ Mobile Radio, AL, voice-synthesized weather at 0603 (Lacroix-France).
4500.0 OSN-Belgian Navy, Oostende, RTTY channel availability marker, at 2059 (ALF-Germany).
4514.0 MOAWIN-Pakistan Navy oil tanker Moawin, working KW, unknown, also on 8143, ALE at 2044 (MPJ-UK).
4553.5 ZHID-German Customs Cruiser Hiddensee, calling ZLST, Cuxhaven, ALE at 0829 (Lacroix-France). ZLST, working ZRUE, Cruiser Rügen (DLVC), at 1755 (MPJ-UK).
4559.5 HAM-VA National Guard, Hampton; also on 4790, 6767.5, 6876.5, 8137.5, 9295, 10362, and 10703; ALE at 1246 (Metcalfe-KY).
4560.0 YHF-E10, 8-group message at 0232 (Boender-Netherlands).
4625.0 The Buzzer-Russian military marker for UVB76, at 0609 (Lacroix-France). [Buzzer continues on and off, with increased voice on frequency. -Hugh]
4675.0 Reach 142-USAF Air Mobility Command C-17A, answered selcal EQ-KS from Gander, at 0733 (Lacroix-France).
4790.0 BROOK-Unknown US military ground station, calling helicopter R26329, ALE at 1500 (Metcalfe-KY).
4835.0 CY46-Algerian Military, working PT40, also 5035, 5065, and 5070, ALE at 2213 (MPJ-UK). MGJ-UK Royal Navy, Forest Moor, RTTY channel availability marker, at 2342 (ALF-Germany).
4836.0 Unid-Russian AM "English Man" (E06), preamble 321 456/15, then message in 15 5-figure groups, at 2030 (Mike-West Sussex, UK).
4880.0 ULX-E10, 12-group message at 2003 (Boender-Netherlands).
4900.0 JCI-Saudi Arabian air field status net, working RFI, ALE at 2107 (MPJ-UK).
5097.0 CFH-Canadian Forces, Halifax, NS, RTTY channel availability marker, at 1953 (MPJ-UK).
5135.0 RACES3-IL RACES station, calling 911CHICAGO, Chicago EOC 911 Office, also on 5140, ALE at 1636 (Metcalfe-KY).
5170.0 Unid-Very chirpy CW signal, sounding like someone whistling, at 1852 (Mike-UK).
5295.0 XDD-UK military, short text messages to XSS, Forest Moor DHFCS control, in a serial data mode, at 1830 (PPA-Netherlands).
5340.0 Ternate Radio-Sultan Babullah Airport, Indonesia, position from a Garuda flight, at 1122 (Eddy Waters-Australia).

5541.0 N235HR-Lear Jet 55 bizjet, answered selcal CG-DK from Stockholm LDOC, Switzerland, at 0657 (Lacroix-France).

5546.5 NAR-US Navy, Saddlebunch Key, FL, repeating downlink of Armed Forces Radio/TV Service Interruptible Voice Channel, supposed to be on 5446.5, at 0200 (ALF-Germany).

5550.0 New York-Caribbean oceanic air control net, selcal check with Springbok 208, South African Airways, at 2337 (Prez-MD).

5598.0 VP-BSO-Shell Aircraft Dassault Falcon 900EX, reporting to Santa Maria, Azores, at 0109. Navy LL97-US Navy, working Santa Maria at 0123 (ALF-Germany).

5634.0 Qantas 64-Flight with position for Johannesburg, enroute Sydney, at 2000 (Patrice Privat-France).

5655.0 Reach 276-USAF Air Mobility Command, working Manila, Philippines, at 1553. UPS32-United Parcel Service MD-11 freighter, registration N250UP, answered selcal HQ-BD from Manila, at 1725 (Privat-France).

5670.0 ALK888-SriLankan Airlines flight 888, reporting waypoint DUGOS at 2054 (Privat-France).

5687.0 GAF 906-German Air Force A310, taking foreign minister to Israel, selcal check BM-QR and setting guard with DHM91, Münster, at 0705 (ALF-Germany).

5708.0 523520-USAF KC-135R tanker number 62-3520, ALE sounding at 0107 (ALF-Germany).

5717.0 Warship Charlottetown-Canadian Forces naval vessel (FFH 339), calling Halifax Military at 0117 (Metcalfe-KY).

5883.0 Unid-Cuban AM Spanish numbers in 5-figure groups (V02a), in progress at 0721 (Lacroix-France).

5898.0 Unid-V02a, in progress at 0727, again at 0800 (Waters-Australia). V02a, callup included "82542," at 0759 (PPA-Netherlands).

5901.0 USDAEOC2-US Department of Agriculture Alternate EOC, MD, also on 9270, ALE at 1554 (Metcalfe-KY).

6435.0 SQLI-Russian military, attempting CW traffic to G8SS, at 1447 (MPJ-UK).

6450.0 NAPOLI-Italian Financial Police, Naples, calling ROMA (Rome headquarters), ALE at 1431 (ALF-Germany).

6519.0 WLO-ShipCom/ Mobile Radio, AL, Caribbean weather at 0026 (Prez-MD).

6535.0 Dakar-African air control, Senegal, handed South African Airways flight Springbok 649 to Atlántico (Recife, Brazil) on 6649, at 0420 (Prez-MD).

6586.0 D-CJPG-Quick Air Jet Charter Lear Jet 35, answered selcal HQ-MP from New York, at 0818 (Lacroix-France).

6622.0 Port Moresby-Regional air route control, Papua-New Guinea, working Airniugini flights, at 0818 and 1012 (Waters-Australia).

6676.0 9VA40-Singapore Volmet, aviation weather at 1851. AXQ429-Australian Volmet, also 11387, aviation weather at 1933 (PPA-Netherlands).

6697.0 MKL-North Atlantic Treaty Organization, Northwood, UK, setting up RTTY with "9-A-H," at 1047 (ALF-Germany).

6721.0 JNR-USAF ground station, Salinas, Puerto Rico, ALE sounding at 2048 (MPJ-UK).

6727.0 LBJ-Royal Norwegian Navy, Bodo, coordinating data mode with "V-7-Y," at 1052 (ALF-Germany).

6733.0 IDR-Italian Navy, Rome, working Daga 02, at 1045 (ALF-Germany).

6754.0 Trenton Military-Canadian Forces Volmet, aviation weather at 0621 (Lacroix-France).

6796.0 TZSE2-Spanish Guardia Civil, North Africa, working TXX1 (Net control, Madrid), at 2140 (ALF-Germany).

6840.0 EZI-E10, callups and messages, parallel 7690, at 0632 and 1432. EZI2, E10 null message, parallel 7690, at 1302 (Boender-Netherlands).

6986.0 SABRE-VA Army National Guard, calling STONEWALL, also 8137.5 and 9295, ALE at 1612 (Metcalfe-KY).

7477.0 2104CTSCSP-CT State Police, also on 7805, ALE sounding at 1310 (Metcalfe-KY).

7535.0 SESEF Mayport-US Navy, FL, advising SESEF Norfolk, VA, to stand by for Vigilante (unknown), at 1655. Beach Storm, testing USB and LSB with SESEF Norfolk, at 2020 (Metcalfe-KY).

7622.0 CS002-Macedonian Army, working RS0011, also 7744 and 8050, ALE at 1807 (MPJ-UK).

7640.8 MORTON25-Polish military, ALE link checks with WATFORD87 and IGIELIT37, at 2045 (ALF-Germany).

7792.0 DIAMANTI-Albanian military, possibly Tirana, working DRINI, Ministry of Information, Drini, ALE at 1811 (MPJ-UK).

7802.0 RACES3-IL RACES, calling IL5, State EOC, at 1613. TLWY1-IL Tollway Agency, ALE text message for IL5, also on 7395, at 1824 (Metcalfe-KY).

7895.0 OMFUF-French Navy, Fort de France, Martinique, calling 2OMFUM, ALE at 2059 (PPA-Netherlands).

7935.0 D11ISP-IL State Police District 11, Collinsville, TLWY1, IL Tollway Agency; same net on 5140, 5192, and 7802; ALE at 2155 (Metcalfe-KY).

8010.0 BI44BI99-Algerian Ministry of Defense, ALE link check with BI10BI99, at 2254 (ALF-Germany).

8137.5 NORMANDY-VA National Guard, calling STONEWALL, ALE at 1801 (Metcalfe-KY).

8337.6 SHARK 11-USCG, possibly Cutter Forward (WMEC 911), calling unknown station "in the red" (clear voice), at 2020 (Metcalfe-KY).

8414.5 003160023-Canadian Coast Guard, Iqaluit, DSC call to 316012550, Canadian oil tanker Heather Knutsen (VABH), at 1555 (PPA-Netherlands).

8416.5 NMF-USCG, Boston, SITOR-B weather, at 1634 (PPA-Netherlands).

8467.5 Unid-Kyodo News, Japan, FAX evening newspaper in Japanese at 60 lines/minute, transmitter in Singapore or Malaysia, at 1719 (Hugh Stegman-CA).

8502.0 NMG-USCG, transmitter in New Orleans, LA, "Iron Mike" synthesized voice with marine weather, at 2144 (Prez-MD) .

8643.5 Unid-Two males, probably fishing boats, salty language in Spanish, LSB at 2131 (Prez-MD).

8764.0 NMO-USCG Honolulu, HI, North Pacific weather by "Iron Mike," at 1230 (Prez-MD).

8855.0 Cayenne, position from Lufthansa 504, then worked an Air France flight in French, at 0400. Piarco, position from Iberia 6658, sent flight to 5526, at 2157 (Prez-MD).

8875.0 ZS1-Moroccan Army, working GS52, ALE at 1658 (MPJ-UK).

8894.0 Afriqiyah 798-Afriqiyah Airways, position for Dakar, Senegal, at 2113 (Privat-France). N'djamena-African air control, Chad, position from unknown flight at 2200 (Prez-MD).

8903.0 Accra-African air control, Ghana, position from Speedbird 64, British Airways, at 2230 (Prez-MD).

8906.0 Air Acores 124-SATA Air Acores flight, position for Santa Maria, at 1658 (ALF-Germany).

8930.0 Easy 4275-EasyJet A320, registration G-EZTW, answered selcal DJ-FH from Stockholm LDOC, at 1258 (ALF-Germany).

8936.0 "09"-HFDL ground station, Barrow, AK, position from Virgin 11, an A340 registration G-VWEB ("Surfer Girl"), at 1651 (PPA-Netherlands).

9016.0 Tascomm-UK Terrestrial Air Sea Communications, passing weather info to unknown aircraft, at 1250 (Lacroix-France).

9025.0 523506-USAF KC-135 tanker number 62-3506, ALE sounding at 2052. 170038-USAF C-5 number 87-0038, ALE sounding at 2053 (MPJ-UK).

9031.0 ASCOT 5103-UK Royal Air Force, working Tascomm Forest Moor, at 0958 (PPA-Netherlands).

9055.0 SSE-Egyptian MFA, Cairo, ARQ with embassy in Havana, Cuba, duplex on 9045, at 2340 (ALF-Germany).

9056.6 NSFHQ1-Possible US National Science Foundation, VA, working OPMHQ1 and OPMHQ2, possible US Office of Personnel Management, also on 6767, 6780.6, 9056.6, and 9064; at 1610 (Metcalfe-KY).

9062.0 Unid-Cuban CW cut numbers in 5-letter groups (M08a), in progress at 0817 (Waters-Australia).

9105.0 SSE-Egyptian MFA, ARQ selcal to TVXK, at 2045 (ALF-Germany).

10057.0 San Francisco-East Pacific air control, clearing Philippine Air 102 to higher altitude at 2358 (Prez-MD).

10084.0 "05"-HFDL ground station, Auckland, New Zealand, uplinks and squitters at 0831 (Waters-Australia).

10315.0 DHN66-North Atlantic Treaty Organization, Geilenkirchen, Germany, working E-3A Magic 63, at 1307 (Lacroix-France).

10648.0 YHF2-E10, null message at 1402 (Boender-Netherlands).

11175.0 Andrews-USAF HF-GCS control, Andrews AFB, MD, long 270-character EAM with distinctive repeating format and common ending block, multi-transmitter echo on signal, at 1413 and 1430. Pull Motor-US military, requesting patch via Offutt HF-GCS (Offutt AFB, NE), but told to stand by, at 2230 (Jeff Haverlah-TX).

11226.0 440190-USAF KC-10A tanker number 84-0190, ALE sounding at 0751 (Lacroix-France).

11300.0 AMB 083-German Civil Air Ambulance Learjet 35A, registration D-CCAA, answered selcal BK-DL from Tripoli, Lebanon, at 1326 (ALF-Germany). Khartoum-African air control, Sudan, checking flight statuses with Cairo, at 2346 (Prez-MD).

11330.0 New York-Caribbean air control, position from Bombardier bizjet FlexJet 5554, at 1435. New York, selcal check with WestJet 2512 (WestJet, Canada), at 1705 (Allan Stern-FL).

12164.0 143CDCC40, Tulsa, OK Health Department (voice call WNG971), working 010CDCNHQ, US Centers for Disease Control, similar on 13488, ALE at 1805 (Metcalfe-KY).

12224.0 Unknown-Russian Mazielka AM selcal, no decode, at 0617 (Waters-Australia).

12365.0 VMC-Australian BOM, Charleville, weather at 1247 (PPA-Netherlands).

12464.0 RKW95-Russian Navy vessel, CW no-traffic check-in, at 1514 (PPA-Netherlands).

12579.0 NMF-USCG, Boston, SITOR-B maritime information at 1702 (Lacroix-France).

13101.0 KLB-ShipCom, Seattle, WA, voice synthesized "female" with Pacific weather, at 1706 (Prez-MD).

13107.0 XSG-Shanghai Radio, China, marine phone patches in Chinese, at 1035 (PPA-Netherlands).

13182.0 XSQ-Guangzhou Radio, China, Chinese phone patches at 1020 (PPA-Netherlands).

13215.0 280053-USAF C-17 number 98-0053, working CRO (Croughton AFB, England), at 1006 (PPA-Netherlands).

13220.0 HARLY46-Italian Air Force, Pisa, calling 50, ALE at 0821 (PPA-Netherlands).

13297.0 Lufthansa 534-Flight working Piarco, Trinidad, at 1815 (Privat-France).

13306.0 Gander-NAT-C, position from Alitalia at 1820 (Prez-MD). New York-NAT-A, position from Martinair 665, at 2002 (Stern-FL).

13354.0 New York-NAT-E, position from KLM 757 at 1704 (Prez-MD).

13927.0 AFA6DD-USAF MARS, TX, morale patch from USAF B-1B Rama 31 to commercial number, at 2127 (Stern-FL).

14485.5 DZ-UK military, calling XSS (DHFCS, Forest Moor) at 1237 (PPA-Netherlands).

14670.0 CHU-Canadian National Research Council, Ottawa, standard time beeps in reduced-carrier upper sideband (R3E) emission, at 1510 (MPJ-UK).

14778.5 Unid-North Korean MFA, Pyongyang, encrypted messages in 600/600 ARQ; also on 14977.5, 16118.5, 16233.5, and 18523.5; at 0055 (Waters-Australia).

15016.0 Smuggler-US military, 48-character EAM simulcast on 8992 and 11175, then "standing by for traffic," at 1331 (Haverlah-TX).

16067.7 Unid-Egyptian MFA, Cairo, Arabic SITOR-A message at 1238 (PPA-Netherlands).

16314.0 YW3-Unknown station calling TXZ5, ALE at 1200 (Waters-Australia).

DIGITAL DIGEST

DIGITAL MODES ON HF

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UK Mil Ops and UnID "ECO" Net

This month, we have news of more unusual UK MIL signals and an interesting NVIS ALE net, but first, some feedback from readers like you.

❖ Bulgarian Diplomatic Service

We covered the HF activities of MFA Sofia in the December 2010 column as part of the "What can I hear with simple gear?" segment. This prompted Paul Beaumont, a member of the ENIGMA 2000 group, to write in with some information about the goings-on at the Bulgarian Embassy in London. He writes:

In March 2005 the Bulgarian Embassy, Queen's Gate, London SW7 was fitted with a satellite dish; a massive thing that looked as though it was able to upload as well as receive. It was pointing almost south, not your usual orbit. That eventually disappeared overnight with just the fittings left to stand evidence of its existence.

The general trend around the embassies in London was the apparent loss of any radio capability; I have also noticed the removal of antennae from the Bangladesh Embassy, the Iraqi Embassy, and the antenna above the Chinese Embassy looks so neglected that will probably come down, too.

The only Embassies where radio capabilities now look possible are the Algerian, Polish, Japanese, Pakistan, Sudan and, at a push, Chinese facilities.

Recently I noted that the remaining radio antenna atop the Bulgarian Embassy, the VGDSh cage dipole and been joined by a beam (see picture), so whilst all the other Embassies are shedding aerials, what is it that the Bulgarians know we don't? I might add that a T2FD also appeared at the same time at the back of the Embassy building.

Thanks for the news and the picture, Paul.

❖ UK MIL Signals

We've covered some interesting movements in the British Military's HF operations recently. First came the 75bd/850 STANAG4481 "RATT" transmissions with almost daily frequency changes, shortly followed by a move to STANAG4285 high-speed modems with the same behavior. Those signals ceased around late summer.

In late November, we were greeted by a 300bd/850Hz shift STANAG4481 FSK signal that occupied a number of channels used years ago by Piccolo stations located in London, Cyprus, and Gibraltar. The 300bd signal has since been pinned to RAF Akrotiri on Cyprus. Here are the channels used so far by this rare signal: 2638.7, 2811.7, 6776.7, 6955.2, 8083.7, 11037.7, 14405.2, 16357.7, 16358.7, and 18537.7 kHz

Meanwhile, the mysterious modified 51 tone WinDRM modem (also believed to be operated by British Forces and which appears to link London and Cyprus) has also made moves. This station started life using regular WinDRM with a call of "A20", "CALL01" or "CALL02," and it sometimes sent short 4 or 5 figure messages like "8294 4710 3931 7402."

WinDRM (sometimes called HamDRM) is an amateur version of the digital broadcast standard DRM (Digital Radio Mondiale) without the codec (digital coder/decoder) licensing requirements. After bouncing around for a few months, this station switched to a version of WinDRM that does not use the three pilot tones, and it settled on a number of regular channels: 3844.65, 4492.15, 4599.65, 4790, 5339.5, 7789.5, 10320.5, 10428.65, 12199.65, 13496, 16164.5, 18060.5, and 18192.5 kHz

Speculation is that this station replaced the 193.5bd 4FSK signal to London and Cyprus (placed by direction finding fixes), which shares the same operating behavior.

❖ The "ECO" ALE Network

In late November 2010, a number of listeners, including Jon-FL in Florida and myself, began to stumble across MIL-188-141A ALE from a series of stations using identifiers like "ECO02" and "ECO11." Initially, a few frequencies in the 6, 9 and 10MHz regions were identified, but it wasn't until more were found that a frequency plan started to emerge. Here are the channels and identifiers noted so far:

6 MHz: 6843, 6861 kHz USB
9 MHz: 9084, 9087, 9091, 9140, 9150 kHz USB
10 MHz: 10135, 10160, 10176.5, 10187, 10193, 10218, 10222, 10234, 10244 kHz USB
Identifiers: ECO01 to ECO15, OMEGACERO

Most surprising is that each pool of channels is clustered together very tightly. Jon's monitoring of the timing of ALE "sounds" by the stations indicates that we're missing at least one channel in each of the 9 and 10 MHz pools. 6 MHz also appears to be missing many channels. Here's an example of the scan pattern recorded by Jon to illustrate this point:

```
0158z  6861  snd ECO09
(we're probably missing next channel)
0202z  9084  snd ECO09
0203z  9087  snd ECO09
0204z  9091  snd ECO09
0205z  9140  snd ECO09
0206z  9150  snd ECO09
(and here)
0208z 10135  snd ECO09
0209z 10160  snd ECO09
0210z 10176.5 snd ECO09
0211z 10187  snd ECO09
0212z 10193  snd ECO09
0213z 10218  snd ECO09
0214z 10222  snd ECO09
0215z 10234  snd ECO09
0216z 10244  snd ECO09
```

The channel pool in this network is in contrast to most HF networks which typically use around 20 channels widely spaced 2 to 20 MHz apart. This maximizes the chances of connecting distant stations under a variety of propagation conditions and times of day.

But what if you want to provide a good chance of connecting relatively local stations over HF? This is where many organizations choose NVIS (Near Vertical Incident Skywave) systems. Special antennas are used that direct most of their radiation upwards and rely on using a frequency that guarantees that most of that radiation is reflected down to earth. This gives good all-round coverage for stations up to a couple of hundred miles apart. Frequencies chosen tend to be from 3 MHz to 7 MHz, but can be as high as 14 MHz (not that we've seen solar conditions good enough for that frequency in years!).

This is probably what's going on with the ECO net. If you followed our coverage of the mystery "M42" network (see *MT* July 2009 and October 2009), which was eventually revealed by a listener to be the Mexican Green Angels (Los Angeles Verdes), that's a perfect example of a local coverage NVIS network.

Who operates the ECO network? We don't know yet, but Mexico, Central America, or the northern countries of South America are a good bet, based on the fade-in and fade-out times for the network at my location. But these signals are very weak up here in Maine and, as usual, any help by more local listeners would be appreciated in uncovering the origin of these signals.

Until next time, enjoy your digital listening and please keep the letters and emails with your suggestions coming.

ON THE HAM BANDS

THE FUNDAMENTALS OF AMATEUR RADIO

Kirk A. Kleinschmidt, NT0Z
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The Right Antenna Tuner for the Job

The other day, a ham buddy of mine stopped by and dropped off his brand new Yaesu FC-30 antenna tuner – not so I could see it, drool over its exquisite industrial design, or even test it on one of my rigs – but to help him sell it on eBay (where I have carefully maintained a 100% positive feedback rating for the past 13 years)!

The FC-30 is an autotuner that bolts onto the side of Yaesu's FT-897-series radios and provides antenna system tweaking in a package that's designed to look good and work well with the company's popular '897 radios.

We had only recently put up a large horizontal loop antenna at my friend's new suburban QTH. Tall trees and friendly neighbors had, for once, worked in a ham's favor. The loop, cut to fit the lot and the skyhooks at hand and not for any specific frequency, was probably resonant somewhere between 3.5 and 5 MHz.

Having used these antennas for decades, I knew that they would work well fed with 50-ohm coax and a shack-mounted antenna tuner on any band above the fundamental frequency. (Using the antenna below that frequency might require additional shenanigans, but more on that later.)

❖ One Size Doesn't Fit All

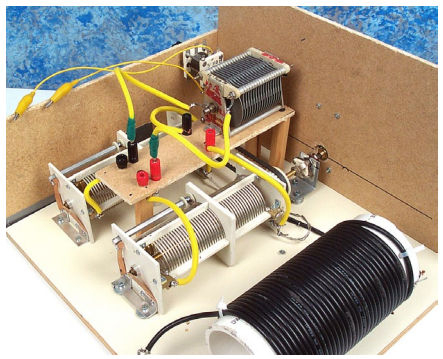
My buddy had been using one of my older-than-dirt MFJ antenna tuners, which hail from an era when hams had to coordinate a flurry of switch throws and knob twiddles to dial in an SWR match. Frantic band-hoppers such as myself became quite skilled at the process, but it wasn't desirable, just necessary. My friend, being a newer, younger ham used to all manner of modern conveniences, didn't like the process one bit (and wasn't all that adept at it, either)! It was reassuring to know that the modern Yaesu transceiver, unlike many rigs from back in the day, was fully SWR-protected and would likely survive any tuning irregularities.

Once we made a tuning log of the various settings required to load the antenna on every possible band (input C, inline L, and output C, and all settings interact with all others!), switching bands wasn't exactly speedy, but it was less tedious. My buddy, however, considered the process antiquated and vowed to "get an autotuner."

Being somewhat style conscious, he ordered the FC-30 matching autotuner instead of an external, non-OEM unit. When he installed and tested the companion tuner it powered up and worked just fine – on some bands but not others!

He called me on the phone and I looked up the FC-30 on line. As I had suspected, the Yaesu tuner wasn't a wide-range unit designed to match any antenna on every band. The specs say it can handle SWR values of 3:1 or less, values you'd expect to see if you were loading up a dipole cut for the high end of 80 meters on the low end of the band, or vice-versa, or if you needed to use a narrowband mobile whip across an entire band, but definitely not for the "dc to daylight" service he had imagined.

So, on the bands where his big loop provided a reasonably low SWR at the shack, the FC-30 tweaked the match a bit further and did exactly what it was designed to do. On bands where the SWR was out of its range, it didn't do much of anything. Again, the tuner was working fine and as designed. It simply wasn't the right tuner for the job at hand.



You know what they say: "When you want something done right you have to do it yourself." I dug my home-brew, somewhat experimental, balanced tuner out of its storage berth last Field Day to show a couple of new hams the deluxe way to tune a quickie antenna fed with TV twinlead. I built Old Betsy about 10 years ago, before I discovered the wonders of antenna-mounted autocouplers. It's big and not exceptionally elegant, but it almost certainly outperforms manufactured tuners in its power class. Based on a "balanced line only" design by Rich Measures, AG6K, the two rotary inductors are synchronized (and linked to a turns-counting dial on the front panel) to maintain circuit balance. The secret sauce is the huge coaxial cable input balun at the lower right. It's not petite, but it offers excellent performance over a wide range of frequencies, something the baluns in most manufactured tuners can't do. – NT0Z

So, the FC-30 is up for sale and the manual tuner is back in action until a wide-range autotuner (or better yet, autocoupler) can be acquired.

Some rigs have internal tuners that can match wide-ranging load impedances, but unless your coaxial feed line is short or you're using a balun and a longer run of open-wire line, using a wide-range tuner in the shack may not be desirable.

Figuring out when to use, how to use, and which type of antenna tuner to use in any situation is often confusing. A lot of the tried-and-true information is misleading or just plain wrong.

Now, I'm not an RF engineer, but I can assure you that, on a practical, real-world level, I'm giving you the straight skinny. I mention this because every time I write about antenna tuners I get a few frenzied e-mails from readers who take exacting exception to something I've said or refer me to past *Aerials* columns by Kurt N. Sterba (which I already own and enjoy!). Acquired the hard way over 30+ years, I would have "killed" to know this stuff when I was starting out and doing most everything wrong!

❖ The Truth about Tuners

Most of these topics warrant a column of their own, and many will receive such treatment in the future. For now, though, here are a few ideas to stir your thoughts:

No drastic measures

Whether manual or automatic, use in-shack antenna tuners with 50-ohm coax only for minor adjustments to antennas that are already "mostly resonant" (the perfect use for my buddy's FC-30). If you try to match impedances that are too drastic, the SWR losses on the coax that runs to your antenna may be so high that much of your RF will be wasted and your results will suffer, possibly dramatically.

Short and sweet

If your coaxial feed line is only a few feet long (like mine was in college when I fed a loop antenna through the window of my second-story shack) or you're feeding an antenna that's in the same room as your transceiver, feed line losses probably won't matter (but RF exposure limits might!).

Use ladder line

If you must keep your antenna tuner in your shack, consider replacing your coax with 450-ohm ladder line or open-wire line. Compared to coax, 450-ohm line is essentially lossless. It's more difficult to install and manage, though, which is why coax became so popular in the first place. Open-wire line *destroys* coax when it comes to SWR losses. In settings where coax losses might reach 3 to 30 dB (using an 80-meter dipole on 160 meters, for example), ladder-line losses might be 0.3 to 6 dB. Ladder line is *the thing* to use for multiband wire antennas.

Most conventional antenna tuners are designed primarily for coax-fed antennas and usually don't work to their full potential when feeding open-wire lines. The problem is with the balun transformer required to accommodate balanced lines and keep them electrically "balanced," which is critical to overall performance, minimizing RFI, etc. If you're making the move to ladder line, consider building or buying a tuner designed expressly for balanced lines.

Feed me right

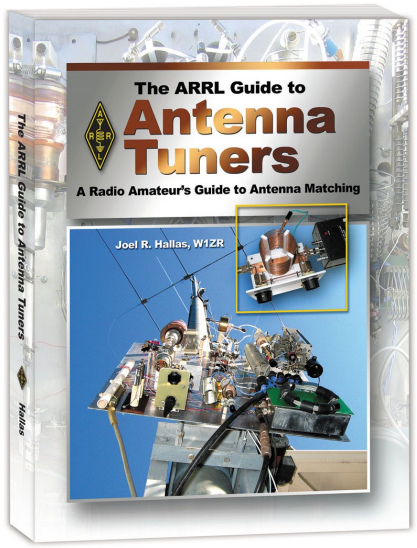
Put the antenna tuner at the antenna feed point! This is sage advice. In-shack tuners are certainly traditional, but from a performance standpoint, placing the tuner in your shack isn't usually a good idea. Remember, antenna tuners tweak the impedance match between your radio and the tuner itself, and if the tuner is located *at the antenna*, the entire run of coax between the two is matched, which results in the lowest possible SWR losses, even when the antenna is being used on multiple bands!

Tuners designed to be mounted at the antenna feed point are often called autocouplers to differentiate them from the autotuner that might be built into your transceiver. Autocouplers are wide-range antenna tuners built into weather-proof (or weather-resistant) enclosures. When you transmit, an internal circuit measures the SWR and automatically configures capacitors and inductors inside the coupler to maximize the power transfer to the antenna (actually, just like internal or in-shack autotuners, nowadays).

Aside from mounting the autocoupler in the first place (which is sometimes a bit of a chore), you don't have to do anything but transmit! Switch bands as fast as you can, because autocouplers typically take one to five seconds to match impedances. Most modern units remember multiple "tuning solutions," which greatly reduces tuning times in the future. Once prohibitively expensive, autocouplers now cost only a bit more than conventional units and are probably the best way to use a single antenna on multiple bands. Look for units manufactured by MFJ, CG Antenna, SGC and others.

Size matters

In a perfect world you could never have an antenna tuner that's too beefy. Matching certain loads can produce extreme RF voltages, so don't be afraid to use a 100-W tuner for QRP work or a kilowatt tuner for "barefoot" operation, etc. In this case, bigger is usually better in terms of efficiency, component quality, etc.



If you want to really get under the hood of this month's topic, check out *The ARRL Guide to Antenna Tuners: A Radio Amateur's Guide to Antenna Matching* by Joel Hallas, W1ZR. In his new book, Joel – *QST* Technical Editor and a former telecommunications systems engineer – does a great job discussing the details of various tuner configurations and antenna system requirements. Through exploring design, construction and application details, you will learn exactly when a tuner is necessary, what type of tuner you need and where to install it for maximum performance. The new *Tuner* book is available from your favorite amateur radio bookseller or $22.95 from **www.arrl.org**; 1-860-594-0200.

Built-in dilemma

The automatic antenna tuner that may be built into your transceiver probably isn't designed to match wide-ranging loads – and by now I'm hoping you wouldn't want to use it that way even if it was!

HF only

Unless you're using an antenna-mounted autocoupler on 6 meters, just forget about using antenna tuners at VHF/UHF. Feed line losses increase rapidly at these frequencies and antenna tuners are rarely useful. Using high-quality, low-loss feed lines is usually the only real solution at these frequencies.

Low enough

If your SWR is 2:1 or less on the frequencies at which you operate, you don't need an antenna tuner. Most modern rigs will tolerate an SWR of 2:1 or less with no difficulty and still put out full power. Many older tube-type rigs can happily output full power into even higher SWRs.

RFI issues

In the modern era, antenna tuners don't *usually* improve typical RFI problems. Many designs reduce *harmonic radiation*, but most RFI is caused by RF overload at the fundamental frequency. Tuners do nothing to reduce this (and may actually make matters worse by helping you radiate an even stronger signal!).

❖ Tuner Efficiency

Ironically, antenna tuners, designed to minimize antenna system SWR losses, suffer from internal losses as they do their job. Even if a particular tuner can effect a match on a certain frequency with a certain antenna, the losses *inside the tuner* can be pretty discouraging.

The ratio between tuner input power and tuner output power defines its efficiency (internal losses). Top-quality tuners usually have losses in the 5% to 15% range, but losses can soar to 50% and even 60% with certain designs under certain conditions.

Internal losses are often at their worst when matching antennas on 160 meters, or when matching extreme load impedances. (Years ago, when testing a particular antenna tuner on 160 meters, a plastic insulator on the main inductor would burst into flame in time with my transmitter keying at the 100-W level! On all other bands, where the efficiency was much better, the tuner worked fine and had reasonable losses.)

They're not lossless, magical boxes, but when used correctly and with the right feed lines and system placement, antenna tuners can produce magical results.

GETTING STARTED

THE BEGINNER'S CORNER

Ken Reitz, KS4ZR
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Cord-Cutter's Primer

I was highly amused back in December to read a piece in the New York *Times* about Americans who are pulling "free TV signals out of the air with the modern equivalent of the classic rabbit-ear antenna." No, these people aren't down-and-outers watching TV in the shadow of the dumpsters in which they live. These are upper middleclass folk with high-tone job descriptions.

So, what's going on here? They're part of a new phenomenon called "cord cutters," people who are ditching cable and satellite-TV in favor of (gasp!) watching free, over-the-air TV. What next?!

❖ Numbers Game

As predicted by many cynics, the switch from analog to digital TV in June 2009 resulted in a huge windfall for the cable and satellite-TV industry as millions of frightened consumers, worried about not being able to watch their favorite network TV shows, signed up. But, two things happened to annul the shotgun wedding: Wholesale economic collapse and "cable-satellite-TV hangover," the news that the cable or satellite-TV introductory offer was just a cruel tease. Once the six month or one-year initial contract was up, the reality of having a $150-200 per month TV bill became a splitting headache.

Buoyed by the earlier growth numbers from June 2009, the satellite and cable-TV companies were flying high. But, then the economy continued to shrink; anyone who still had a job was trying to cut expenses and exorbitant entertainment bills were first on the chopping block. But, there was a hitch. Many cable companies were bundling their bills: cable-TV, telephone and high-speed Internet access all came on the same bill because they were provided by the same company. So, this past year, hundreds of thousands of cable-TV subscribers opted to de-bundle the TV part of their cost, keeping their indispensable Internet access.

The result was that, for the first time in the history of the cable-TV industry, subscriber numbers began to fall. While DirecTV satellite subscriber numbers were up in 2010, DISH Network numbers fell most of last year.

Still, most cable and satellite-TV spokespeople deny there is a problem. But, what the cord-cutters discovered is that off-air TV is free, in high-definition, and includes reception of ancillary channels such as weather, music, and smaller networks not available on either satellite-TV or cable. They also discovered that many of their favorite cable-TV programs can be seen on-line for free, usually at a network or show's home page, a benefit of keeping their high-speed Internet access.

❖ Cord-Cutting Antenna Options

After the initial DTV switch, a number of stations received permission from the FCC to adjust their antennas or transmitter power to make up for the "digital deficit," the difference in reception quality between analog and digital signals. Still, best reception is had using an outdoor antenna. While most stations migrated from VHF to UHF after the switch, enough stations remained on VHF to make it impossible to use a UHF-only antenna to receive all channels. Antenna manufacturers have changed the design of their off-air antennas to reflect the change in channel assignments.

Getting the best off-air TV reception depends on your circumstances. If you live in an apartment or condo you may have to deal with an indoor antenna. While traditional "rabbit ears" are the cheapest, they're the least effective and, basically, you get what you pay for. The best reception I've had indoors was with a Winegard SquareShooter, a clever little antenna that's 16 inches square and only 4 inches deep. It's a plastic, flat antenna that comes without an amplifier (the SS-1000 at $108) or with an amplifier (the SS-2000 at $130). Spend the extra bucks and get the amplified version.

Winegard's amplified SquareShooter 2000 ($71 plus shipping and handling) mounting options include balconies, exterior wall, patios, even the attic where it could be mounted on a rotator for even better performance. (Courtesy: Winegard)

The advantages of the SquareShooter are a wide range of mounting options; its small size fits nearly anywhere; the added amplifier increases range, and it may be rotated for maximum reception. Its unusual design makes it a perfect hidden antenna, very difficult for the "sight police" to see and object to. I used it mounted inside and outside in tests. Of course, best reception was outside. I also found the SquareShooter very effective in areas where multi-path distortion (what used to be known as "ghosting") is prevalent.

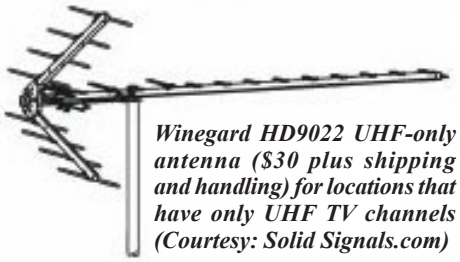
Next up the ladder is a VHF/UHF TV antenna such as the Channel Master CM2020. This one is designed to receive channels 7 through 69. It's for those locations that still have one or two VHF stations operating. If you're in a UHF-only area, opt for a Winegard HD9075 mast-mounted antenna and add a pre-amplifier for extended range.

Unless you're in the unusual situation of having all your TV stations in one direction, you'll need an antenna rotator. Prices for these are in a narrow range from $60 to $100. And, unless you can place the rotator control at your chair side, opt for models that include remote control operation.

Channel Master CM2020 VHF/UHF antenna ($69 plus shipping and handling) covers channels 7-69. Add a Channel Master 0068DSB pre-amplifier for even better performance. (Courtesy: Solid Signals.com)

❖ Antenna Mounting Options

By amateur radio standards, even the biggest TV antennas are small stuff. If you have a ham antenna tower, consider mounting your TV antenna on the ham tower, just keep the TV antennas one-half wavelength from other antennas. If you're starting out putting together an outdoor TV



Winegard HD9022 UHF-only antenna ($30 plus shipping and handling) for locations that have only UHF TV channels (Courtesy: Solid Signals.com)

antenna, avoid chimney mounts, as the twisting motion of a large antenna in the wind can actually crack mortar in a brick chimney and loosen the weather fittings around a steel chimney.

You can get away with using one length of 5 foot mast secured to the exterior wall by stand-offs with the top of the mast just above the roof line, but a better method is to extend the masts all the way to the ground supported by a cement block. This takes the stress of the weight of the antenna system off the wall and puts it on the ground. It also lets you mount a grounding system, composed of an 8 foot copper ground rod and ground strap attached to the antenna mast. Radio Shack carries 5 foot sections of 16 gauge steel mast for $15 apiece, which is a good buy because you can avoid shipping charges by buying them directly from your local store.

Once you have the top of the mast above the roof line, mount the rotator and then the antennas with their pre-amplifiers attached, on an additional mast. Don't forget to make a drip loop (extend antenna cable so that it loops down before entering the exterior wall) to prevent rain from following the cable into the house. And, while you're on the ladder and roof, please take care; don't waste your life just to tune in TV stations. If you're unsure about your own capabilities, hire a professional TV antenna installer and let them take all the risks; it could be worth a lot to your family. Try to make it so that your antenna is at least 5 to 10 feet above the roof – any more and you'll need guy wires to keep it from blowing over in a stiff wind.

❖ Cord-Cutting Step 2

Missed your favorite network shows and don't have an expensive TiVo box to record them? Most current network TV shows are available to download from the Internet for free, but who wants to watch on a little 17 inch computer monitor? You need to be able to transfer the image to your TV, and to do this you'll need an interface. Among the determining factors for finding a suitable computer-to-TV interface are: the age of your computer, whether it's a desk top or laptop, or if it's a PC or Apple. Add to those considerations the issues regarding the TV on which you want to watch, including age of the TV, type of inputs available, and remote control flexibility.

Terk TV-2 passive rabbit ears ($17) are the bottom of the line and effective only in urban or suburban areas where you're within 10-15 miles of the transmitter with no other antenna options. (Courtesy: Solid Signals.com)

You can spend a lot of money on expensive converters and various cable assemblies, so make sure you have a good return policy from the vendor before you buy. I sent more than $100 worth of cables and attachments back to various vendors when they turned out not to fit or function as sales staff said. Pay attention to product reviews on vendor web sites; they're rarely censored and customers can be very blunt. Take advantage of 800 number sales staff who should be able to help, as well as on-line tech support. I had a great online conversation with a Sony tech support woman from India who correctly indentified the problem I was having.

Large Digital Video Interface (DVI) cable ($12-20) carries HDTV and audio signal in one cord but won't fit many newer TVs and computers which use the much smaller HDMI input. (Courtesy: Google.com)

Once you have the correct cables, you can start watching online TV through your computer, which is much easier done with a laptop that can be placed next to the TV and manipulated from across the room with an infrared mouse. To start your cable-TV cord-cutting, you will need a decent Internet connection. Sorry, dial-up won't cut it. But, even something as simple as a portable air-card will. At about $40 per month you'll have the high-speed Internet access you'll need to watch videos online (though not in high-def) and listen to online music sources such as Pandora. If you run your air-card through a router you'll have whole-house Wi-Fi coverage and can use your laptop with any TV in the house.

There's a limit to what you can watch and the status of online free viewing may change considerably this year, as cable and off-air networks grapple with how to make money from your changing viewing habits. Among the many notably absent channels are those from ESPN. But, you'll be surprised to see what *is* available, including archived shows. One source that offers hundreds of TV shows is **www.hulu.com**. You won't live long enough to see all the shows they've archived, but that's just as well, because most of them weren't worth watching when they were new!

We ditched our satellite TV subscriptions two years ago at our house and instead we watch high-def off-air TV, streaming video, and movies with a Netflix subscription. I don't even miss ESPN (though that was the hardest to kick); instead, we read more!

PROGRAMMING SPOTLIGHT

WHAT'S ON WHEN AND WHERE?

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Cold Winds and Warm Sounds

Welcome to the February edition of *Programming Spotlight*. Gives you chills just saying the word "February" doesn't it? (At least for those of us in northerly climes.) But of course, for every cold spot on the planet there is a gloriously warm one. So this month I'll try to take your minds off snow, wind, ice and cold, and instead shine the *Programming Spotlight* on broadcasters from sunny climes, where the only thing drifting may be sand dunes, and the only thing freezing is the ice in your drink. Makes you feel warmer already!

To complete the illusion all one needs to do is tune in on an older type receiver and feel the warmth of the radio tubes. I had an old Nordmende receiver for years, that used to give off enough heat to warm up the room, or so it seemed at the time!

CUBA

Listening to **Radio Habana Cuba** is in some ways like stepping back into a time capsule where the Cold War never ended. Each broadcast opens by informing the listener that **Radio Habana Cuba**, (is) broadcasting from Cuba, "free territory in the Americas." **RHC** has a mellower interval signal than in the past (years ago it sounded like a military march). In 2011, they use a "kinder gentler" synthesized version. The tune has always been vaguely reminiscent of an old shaving cream commercial from my youth.

Doing some casual listening lately, **Eva Barajas** (?) **Ed Newman** and **Bernie Dwyer** were noted doing the news, commentary and presenting duties. There is only one hour of new programming per day (it seems to me that in the past there was much more per day), which is repeated over the course of the day. I suppose the same budgetary constraints that all shortwave stations face are affecting the output of **RHC**.

News is largely Cuba-centric, featuring lots of meetings between Cuban officials and South and Central American politicians, solidarity with the Palestinians and so on. **RHC** spends a lot of time promoting Latin American countries such as Bolivia, Venezuela and Nicaragua, which have left leaning governments.

Some great Cuban music can be heard but not enough! I seem to recall in the past much more of this wonderful music on a daily basis. Perhaps if **RHC** played a bit more music and aired a bit less politics, they would be more successful. As it is, four or five consecutive days of listening made my head hurt. A softer approach might make their message more palatable. In attempting to answer a letter during the ***Mailbag Show***, the announcer did his best to assure a listener in the United States that Cuba didn't consider the United States an enemy. But the rest of the week made it pretty clear that the two countries are far from being each other's BFF (Best Friend Forever in internet lingo).

Each one-hour broadcast from Cuba includes the following elements: The first half hour consists of ***News and Commentary***, an in depth look at one of the stories of the day, ***Sports*** *and* ***Cuban Music***. The second half hour opens with another news brief, another commentary, and then a daily feature on the following rotation: Sunday – ***Caribbean Outlook Show***, Monday – ***Dxers Unlimited***, Tuesday – ***Mailbag Show***, Wednesday – ***Breaking the Silence*** (reports about The Cuban 5...five Cubans arrested for espionage in the US...or anti-terrorists from the Cuban viewpoint), Thursday – ***Caribbean Outlook Show***, Friday – ***World of Stamps*** and ***Breakthrough***. On Saturdays most of these weekly features are reprised during the hour program.

This month if you are so inclined, you can enter the contest marking the 50th anniversary of Radio Habana Cuba. The question to be answered is: "What has Radio Habana Cuba meant to you during its 50 years on the air?" The deadline for entries is March 31, 2011. Judging from on-air comments they want detailed responses and promise 50 prizes. Send your entries or any other correspondence to Radio Habana Cuba, PO Box 6240 Habana, Cuba or via email at *radiohc@enet.cu*

Radio Habana Cuba also provides one with the opportunity to hear some rather unique languages. RHC broadcasts daily in Quechua and Creole, and weekly on Sundays in Esperanto. Quechua, spoken in the Andes, can be heard daily at 0000-0030 UTC on 15370 kHz. Creole broadcasts for Haiti can be heard also on 15370 kHz from 23-2330 UTC and on 5040 kHz from 01–0130 UTC. On Sundays, one can hear Esperanto broadcasts on 6010 kHz from 07-0730 UTC and on 11760 and15370 kHz from 15–1530 and 2230-2300 UTC.

"Esperanto is the most widely spoken constructed international auxiliary language. Its name derives from *Doktoro Esperanto* (Dr. Hopeful), the pseudonym under which L.L. Zamenhof published the first book detailing Esperanto, the Una Libro, in 1887. Zamenhof's goal was to create an easy-to-learn and politically neutral language that would serve as a universal second language to foster peace and international understanding." It is thought that anywhere from 10,000 to 2 million people speak Esperanto. (Wikipedia) **Radio Habana Cuba** is one of a very few broadcasters to maintain an Esperanto service.

GABON

One of my favorite catches on a cold winter's day is **Africa No. 1** in Libreville, Gabon. The lively African rhythms alone are worth hearing. (A rudimentary understanding of French doesn't hurt, but is not necessary to enjoy this station.) Although it is on the air from 0500-2300 UTC on 9580, your best bet might be around 0500, or later in the day around 2100 UTC on.

If you strike out hearing it on shortwave, head for the **Africa No.1** website and dive in. You can hear the programming online by going to **www.africa1.com** and clicking the big black button at the top of the page. I recently listened for hours in this way...something I did routinely years ago via the radio.

NIGERIA

Look for programming from the **Voice of Nigeria** on the following frequencies: 15120 kHz from 05-07 UTC and 17-21 UTC, 9690 kHz from 10-15 and 21-23 UTC. According to the **Voice of Nigeria** website (**www.voiceofnigeria.org**) a wide variety of programming is available. The **VoN** website is looking much better than it did a year or so ago when I last looked at it. However, it still seems to be a work in progress. An ambitious list of podcasts is promised. Clicking on the limited number of links to them takes you to a blank page with the phrase "Coming Soon."

Hopefully in the future this will be a way to access Nigerian programs. Perhaps it's just a lack of funding. Maybe they can get access to the millions of dollars being held in the estates of dead African dictators that I keep being offered in my email inbox.

SOUTH AFRICA

Channel Africa is another station with ambitious plans for the Internet age. As with many stations around the world, **Channel Africa**, which used to boom into North America when it was known as **Radio RSA** during the Apartheid era, has cut back, limiting its shortwave coverage to the African continent, making reception here somewhat more difficult. Like **Voice of Nigeria**, the audio files on the **Channel Africa** website were unavailable or would not work (I tried on two different computers).

On shortwave try 15235 kHz around 1700 UTC, reported by Mark Coady in Ontario with decent reception late in 2010. ***Africa Digest*** was heard at this time. ***Africa Digest*** "the energetic evening current affairs show, (is) produced by the current affairs team and presented by **Luyanda Maome**. The show is broadcast every week day."

AUSTRALIA

The coverage by **Radio Australia** of Asia-Pacific affairs will certainly take your mind off the snow piling up outside your door. Programs like ***Asia Pacific*** bring you coverage and analysis of headline making events throughout the South Pacific. It can be heard weekdays at 1005, 1305 and 1505 UTC. ***Pacific Break*** is a podcast devoted to "uncovering the best original musical talent in the Pacific. ***In The Loop*** is a mix of music and interviews from the Pacific and celebrates the cultures and peoples of the Pacific. Listen weekdays at 0305 UTC on the English Stream of RA's webcast.

You can find links to these programs and more, most of which are available as podcasts, at the **Radio Australia** website **www.radioaustralia.net.au/programguide/**

NEW ZEALAND

Like **Radio Australia**, **Radio New Zealand National** and **Radio New Zealand International** have a wide range of programming rather warmer in spirit at any time of year. Like Radio Australia, **RNZI** keeps you up-to-date on issues of concern in the Pacific Region, covering stories that never get covered in the press on this side of the ocean. ***Dateline Pacific*** can be heard via **RNZI** Monday-Friday at 0308, 0708, 1108, 1308, 1608, 1815 and 2015 UTC and Sunday-Thursday at 2215 UTC. It is RNZI's flagship program, covering the major Pacific stories of the week. Listen to ***Dateline Pacific*** to learn more about what's happening in this under-reported part of the world.

Hopefully this brief survey will steer you in the direction of some tropical sounds to while away our far too lengthy winter months. If you have other suggestions please let us know!

❖ Hail, Fenwick!

Fans of the late Peter Sellers will remember a movie called *The Mouse That Roared*, in which the tiny, fictional European Duchy of Grand Fenwick concocts a scheme to get money from the US government, by losing a war. Except that the plan goes awry and they accidentally win! I always think of this film when I hear **Radio PMR** in the breakaway republic of Pridnestrovie. The proper name is Pridnestrovskaia Moldavskaia Respublica (Pridnestrovian Moldavian Republic), which has a population roughly that of Hamilton, Ontario or Buffalo, NY. It consists of a bit over 4,000 square kilometres of territory sandwiched between Moldova and Ukraine. Pridnestrovie's de facto independence is not recognized by any UN member and it only has diplomatic relations with two other breakaway republics, South Ossetia and Abkhazia. While not recognizing it, Moscow is generally thought to be backing it.

Radio PMR can be heard daily on 6240 kHz at 2230 UTC. My friend and fellow ODXA columnist Mark Coady reports hearing it in November "with a man with 'This is the next analytical program of the **Radio PMR**' and into news then contact info at 2244 and **'Radio PMR** on the air' and into local music – Very Good Nov 3 – new time and longer program – 30 minutes per language vs. 15 minutes in A10. Plus, just before 2200 they have a rousing national anthem. I was a regular listener before and think that this one is now really well worth listening to."

❖ What's New

Voice of Russia

There is a whole array of new programs from the **Voice of Russia** listed on their website. Some or all of them may be audible on the radio schedule, but many are not listed on the online program schedule... yet. Some MAY be just web based at the moment. This will all shake out in the coming weeks.

Home from Home - "Each week Sam Gerrans speaks with a different foreigner who now lives in Russia.

"His guests describe their background, their thoughts about Russia before they came, the reality they found here, and the life and work that keeps them here. They also reflect on how life here has changed them personally and their attitude towards their home culture."

As this is written only four episodes have been produced, featuring the Mexican Ambassador to Russia, and three other "average" citizens who moved to Russia from the US and England. **Home from Home** does not appear anywhere in the online program schedule, as of this writing but audio is available via the **Voice of Russia** website.

Russian Bookworld - A weekly look at books from and about Russia and the context in which they are written, produced, translated and marketed. Programs have looked at the Moscow Non-Fiction Book Fair, the Centenary of Tolstoy's death and modern day Russian writer Maria Galina. ***Russian Bookworld*** also does not appear on the program grid at this time. Like ***Home from Home***, it too can definitely be heard on the **VOR** website.

Burning Point - A daily program focusing on some of the most significant and controversial events rocking our world and making it more vulnerable. But only if we don't care to take a deeper look at what's going on...This appears to be one of the most interesting new programs, so far covering such issues as the Iranian and Pakistani nuclear programs, the rise of Brazil as a world power, the Wikileaks issue and the ramifications of forthcoming elections in Egypt. It seems to be a very serious and thoughtful program. ***Burning Point*** can be heard UTC Tuesday-Saturday at 0330, 0830 and 2330.

In Between - Another new program which, as the name suggests, doesn't really have a set topic but covers a wide and varied number of issues, that perhaps don't fit into the other programs of the **Voice of Russia**. Topics covered have so far included alternative energy sources in Russia, the 2018 World Cup to be hosted by Russia, the increasing number of Russians making purchases on the Internet, and privatization in Russia. Donna West and Dmitry Vostok host the program, (which both sound to me like rather clever pseudonyms. Vostok is Russian for "East"). ***In Between*** can be heard UTC Tuesday-Saturday at 0130, 0430, 1130 and 1930 and of course online.

Listen to all of these at **http://english.ruvr.ru/radio_broadcast/**

❖ Programming Advance Notice

So how does one figure out what's on the radio in the coming days so you don't miss something special? In the 1980s when all of this information came by postal mail, it was often problematic to get any advance programming information, because by the time it got to you it was often out of date. Not so in today's connected Internet world.

Many stations and programs will send you advance programming information weekly (or even daily), delivered right to your e-mail inbox. Each month we'll highlight one of these newsletters and tell you how to get it, so you don't miss out on a program of interest.

Radio Australia - You can subscribe to a number of newsletters from the **ABC** in Australia, which will keep you informed about upcoming broadcasts of both **Radio Australia** and the **ABC** domestic networks. Check them out at: **www.abc.net.au/rn/newsletters/**

How to Use the Shortwave Guide

0000-0100 twhfa USA, Voice of America 5995am 6130ca 7405am 9455af

① ② ⑤ ③ ④ ⑥ ⑦

CONVERT YOUR TIME TO UTC

Broadcast time on ① and time off ② are expressed in Coordinated Universal Time (UTC) – the time at the 0 meridian near Greenwich, England. To translate your local time into UTC, first convert your local time to 24-hour format, then add (during Standard Time) 5, 6, 7 or 8 hours for Eastern, Central, Mountain or Pacific Times, respectively. Eastern, Central, and Pacific Times are already converted to UTC for you at the top of each hour.

Note that all *dates*, as well as times, are in UTC; for example, a show which might air at 0030 UTC *Sunday* will be heard on *Saturday* evening in America (in other words, 7:30 pm Eastern, 6:30 pm Central, etc.).

FIND THE STATION YOU WANT TO HEAR

Look at the page which corresponds to the time you will be listening. English broadcasts are listed by UTC time on ① , then alphabetically by country ③, followed by the station name ④. (If the station name is the same as the country, we don't repeat it, e.g., "Vanuatu, Radio" [Vanuatu].)

If a broadcast is not *daily*, the days of broadcast ⑤ will appear in the column following the time of broadcast, using the following codes:

Codes	
s/Sun	Sunday
m/Mon	Monday
t	Tuesday
w	Wednesday
h	Thursday
f	Friday
a/Sat	Saturday
occ:	occasional
DRM:	Digital Radio Mondiale
irreg	Irregular broadcasts
vl	Various languages
USB:	Upper Sideband

CHOOSE PROMISING FREQUENCIES

Choose the most promising frequencies for the time, location and conditions.

The frequencies ⑥ follow to the right of the station listing; all frequencies are listed in kilohertz (kHz). Not all listed stations will be heard from your location and virtually none of them will be heard all the time on all frequencies.

Shortwave broadcast stations change some of their frequencies at least twice a year, in April and October, to adapt to seasonal conditions. But they can also change in response to short-term conditions, interference, equipment problems, etc. Our frequency manager coordinates published station schedules with confirmations and reports from her monitoring team and *MT* readers to make the Shortwave Guide up-to-date as of one week before print deadline.

To help you find the most promising signal for your location, immediately following each frequency we've included information on the target area ⑦ of the broadcast. Signals beamed toward your area will generally be easier to hear than those beamed elsewhere, even though the latter will often still be audible.

Target Areas

af:	Africa
al:	alternate frequency (occasional use only)
am:	The Americas
as:	Asia
ca:	Central America
do:	domestic broadcast
eu:	Europe
me:	Middle East
na:	North America
pa:	Pacific
sa:	South America
va:	various

Mode used by all stations in this guide is AM unless otherwise indicated.

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SHORTWAVE BROADCAST BANDS

kHz	Meters
2300-2495	120 meters (Note 1)
3200-3400	90 meters (Note 1)
3900-3950	75 meters (Regional band, used for broadcasting in Asia only)
3950-4000	75 meters (Regional band, used for broadcasting in Asia and Europe)
4750-4995	60 meters (Note 1)
5005-5060	60 meters (Note 1)
5730-5900	49 meter NIB (Note 2)
5900-5950	49 meter WARC-92 band (Note 3)
5950-6200	49 meters
6200-6295	49 meter NIB (Note 2)
6890-6990	41 meter NIB (Note 2)
7100-7300	41 meters (Regional band, not allocated for broadcasting in the western hemisphere) (Note 4)
7300-7350	41 meter WARC-92 band (Note 3)
7350-7600	41 meter NIB (Note 2)
9250-9400	31 meter NIB (Note 2)
9400-9500	31 meter WARC-92 band (Note 3)
9500-9900	31 meters
11500-11600	25 meter NIB (Note 2)
11600-11650	25 meter WARC-92 band (Note 3)
11650-12050	25 meters
12050-12100	25 meter WARC-92 band (Note 3)
12100-12600	25 meter NIB (Note 2)
13570-13600	22 meter WARC-92 band (Note 3)
13600-13800	22 meters
13800-13870	22 meter WARC-92 band (Note 3)
15030-15100	19 meter NIB (Note 2)
15100-15600	19 meters
15600-15800	19 meter WARC-92 band (Note 3)
17480-17550	17 meter WARC-92 band (Note 3)
17550-17900	17 meters
18900-19020	15 meter WARC-92 band (Note 3)
21450-21850	13 meters
25670-26100	11 meters

Notes

Note 1	Tropical bands, 120/90/60 meters are for broadcast use only in designated tropical areas of the world.
Note 2	Broadcasters can use this frequency range on a (NIB) non-interference basis only.
Note 3	WARC-92 bands are allocated officially for use by HF broadcasting stations in 2007
Note 4	WRC-03 update. After March 29, 2009, the spectrum from 7100-7200 kHz will no longer be available for broadcast purposes and will be turned over to amateur radio operations worldwide

0000 UTC - 7PM EST / 6PM CST / 4PM PST

0000	0030		Egypt, Radio Cairo	11590na		
0000	0030	vl	Guyana, Voice of Guyana	3290va		
0000	0030		USA, Voice of America	7560af		
0000	0045		India, All India Radio	6055as	7305as	
			9950as	11645as	13605as	9705al
0000	0057		Canada, Radio Canada International	9880af		
0000	0058		Germany, Deutsche Welle	9445as	9785as	
0000	0100		Anguilla, Worldwide Univ Network	6090am		
0000	0100		Australia, ABC NT Alice Springs	4835do		
0000	0100		Australia, ABC NT Katherine	5025do		
0000	0100		Australia, ABC NT Tennant Creek	4910do		
0000	0100		Australia, Radio Australia	9660pa	12080pa	
			13690pa	15240as	15415as	17715pa
			17750as	17795pa		
0000	0100		Bahrain, Radio Bahrain	6010me		
0000	0100		Bulgaria, Radio Bulgaria	5900na	7400na	
0000	0100		Canada, CFRX Toronto ON	6070na		
0000	0100		Canada, CFVP Calgary AB	6030na		
0000	0100		Canada, CKZN St Johns NF	6160na		
0000	0100		Canada, CKZU Vancouver BC	6160na		
0000	0100		China, China Radio International	6020eu		
			6075as	6180as	7350eu	7415as
			9570eu	11790as	11885as	13750as
0000	0100		Germany, Deutsche Welle	11855as		
0000	0100		Malaysia, RTM/Traxx FM	7295do		
0000	0100		New Zealand, Radio NZ International	15720pa		
0000	0100	DRM	New Zealand, Radio NZ International	13730pa		
0000	0100		Russia, Voice of Russia	6240na	7250na	
0000	0100		Spain, Radio Exterior de Espana	5970na		
0000	0100		Sri Lanka, SLBC 6005as	9770as	15745as	
0000	0100		Thailand, Radio Thailand World Service	13745na		
0000	0100		UK, BBC World Service	5970as	6195as	
			7360as	9410as	9740as	
0000	0100		USA, American Forces Network	4319usb		
			5446usb	5765usb	7812usb	12133usb
			12759usb	13362usb		
0000	0100		USA, EWTN/WEWN Irondale, AL	11520me		
0000	0100		USA, FBN/WTJC Newport NC	9370na		
0000	0100		USA, WBCQ Monticello ME	5110na	7415am	
			9330am			
0000	0100		USA, WINB Red Lion PA	9265am		
0000	0100		USA, WRNO New Orleans LA	7505am		
			15590al			
0000	0100		USA, WTWW Lebanon TN	9479va		
0000	0100		USA, WWCR Nashville TN	5070na	9980na	
			13845na			
0000	0100		USA, WWRB Manchester TN	3215na	6890va	
0000	0100		USA, WYFR/Family Radio Worldwide	5950am		
			6085am	7360ca	9505am	11720ca
			11730ca	15440am		
0004	0100	twhfa	Canada, Radio Canada International	9755na		
0030	0100		China, China Radio International	11730as		
0030	0100	Sun	Palau, T8WH/WHRI/Sound of Hope Radio			
			15680as			
0030	0100	fas	UK, Bible Voice Broadcasting Network	5950as		
0030	0100		USA, Voice of America/Special English	6170va		
			9325va	9490va	9715va	11695va
			12005va	15185va	15205va	15290va

0100 UTC - 8PM EST/ 7PM CST / 5PM PST

0100	0104	twhfa	Canada, Radio Canada International	9755na		
0100	0130		China, China Radio International	11730as		
0100	0130		Vietnam, Voice of Vietnam	6175am		
0100	0157		North Korea, Voice of Korea	7220as	9345as	
			11735am	13760sa	15180sa	
0100	0200		Anguilla, Worldwide Univ Network	6090am		
0100	0200		Australia, ABC NT Alice Springs	4835do		
0100	0200		Australia, ABC NT Katherine	5025do		
0100	0200		Australia, ABC NT Tennant Creek	4910do		
0100	0200		Australia, Radio Australia	9660pa	12080pa	
			13690pa	15240as	15415as	17715pa
			17750as	17795pa		
0100	0200		Bahrain, Radio Bahrain	6010me		
0100	0200		Canada, CFRX Toronto ON	6070na		
0100	0200		Canada, CFVP Calgary AB	6030na		
0100	0200		Canada, CKZN St Johns NF	6160na		
0100	0200		Canada, CKZU Vancouver BC	6160na		
0100	0200		China, China Radio International	6020eu		
			6175eu	9410eu	9470eu	9535eu
			9570eu	9580na	9790na	11870as
			15785as			
0100	0200	DRM	China, China Radio International	6080na		
0100	0200		Cuba, Radio Havana Cuba	6000na	6050na	
0100	0200	vl	Guyana, Voice of Guyana	3290va		
0100	0200		Malaysia, RTM/Traxx FM	7295do		
0100	0200		New Zealand, Radio NZ International	15720pa		
0100	0200	DRM	New Zealand, Radio NZ International	13730pa		
0100	0200		Romania, Radio Romania International	6145na		
			7355na			
0100	0200		Russia, Voice of Russia	6240na	7250na	
0100	0200		Sri Lanka, SLBC 6005as	9770as	15745as	
0100	0200		Taiwan, Radio Taiwan International	11875as		
0100	0200		Uganda, UBC Radio	4975do		
0100	0200		UK, BBC World Service	5940as	5970as	
			9740as	11750as		
0100	0200		Ukraine, Radio Ukraine International	7440na		
0100	0200		USA, American Forces Network	4319usb		
			5446usb	5765usb	7812usb	12133usb
			12759usb	13362usb		
0100	0200		USA, EWTN/WEWN Irondale, AL	11520me		
0100	0200		USA, FBN/WTJC Newport NC	9370na		
0100	0200		USA, Voice of America	7325va	9435va	
			11705va			
0100	0200		USA, WBCQ Monticello ME	5110na	7415am	
			9330am			
0100	0200	sm	USA, WHRI Cypress Creek SC	5920am		
0100	0200		USA, WINB Red Lion PA	9265am		
0100	0200		USA, WRNO New Orleans LA	7505am		
0100	0200		USA, WTWW Lebanon TN	5755va		
0100	0200		USA, WWCR Nashville TN	4840na	5935na	
			7490na	9980na		
0100	0200		USA, WWRB Manchester TN	3185va	3215na	
			6890va			
0100	0200		USA, WYFR/Family Radio Worldwide	6100ca		
			7445am	9505am	15440am	
0104	0200		Canada, Radio Canada International	9755na		
0130	0145	twhfas	Albania, Radio Tirana	6130na		
0130	0200		Iran, VOIRI/IRIB 6120na	7250na		
0130	0200	Sun	Palau, T8WH/WHRI/Sound of Hope Radio			
			15680as			
0130	0200	mtwhfa	Serbia, International Radio of Serbia	6190na		
0130	0200	twhfa	USA, Voice of America/Special English	5960va		
			7465va			
0140	0200		Vatican City State, Vatican Radio	5895va		
			7335va			

0200 UTC - 9PM EST / 8PM CST / 6PM PST

0200	0204		Canada, Radio Canada International	9755na		
0200	0215		Croatia, Croatian Radio	3985eu	7375am	
0200	0227		Iran, VOIRI/IRIB 6120na	7250na		
0200	0230		Thailand, Radio Thailand World Service	15275na		
0200	0257		North Korea, Voice of Korea	13650as	15100as	
0200	0300		Anguilla, Worldwide Univ Network	6090am		
0200	0300		Australia, ABC NT Alice Springs	4835do		
0200	0300		Australia, ABC NT Katherine	5025do		
0200	0300		Australia, ABC NT Tennant Creek	4910do		
0200	0300		Australia, Radio Australia	9660pa	12080pa	
			13690pa	15240as	15415as	15515as
			17750as	21725va		
0200	0300		Bahrain, Radio Bahrain	6010me		
0200	0300		Canada, CFRX Toronto ON	6070na		
0200	0300		Canada, CFVP Calgary AB	6030na		
0200	0300		Canada, CKZN St Johns NF	6160na		
0200	0300		Canada, CKZU Vancouver BC	6160na		
0200	0300		China, China Radio International	11770as		
			13640as			
0200	0300		Cuba, Radio Havana Cuba	6000na	6050na	
0200	0300		Egypt, Radio Cairo	6270na		
0200	0300	vl	Guyana, Voice of Guyana	3290va		
0200	0300		Malaysia, RTM/Traxx FM	7295do		
0200	0300		New Zealand, Radio NZ International	15720pa		
0200	0300	DRM	New Zealand, Radio NZ International	13730pa		
0200	0300	Sun	Palau, T8WH/WHRI/Sound of Hope Radio			
			15680as			
0200	0300		Philippines, PBS/ Radyo Pilipinas	11880me		
			15285me	17710me		
0200	0300		Russia, Voice of Russia	6240na	7250na	
0200	0300		South Korea, KBS World Radio	9580sa		
0200	0300		Taiwan, Radio Taiwan International	5950na		
			9680ca			
0200	0300		UK, BBC World Service	5875me	5940as	
			7445af			

0200	0300		USA, American Forces Network			4319usb
			5446usb	5765usb	7812usb	12133usb
			12759usb	13362usb		
0200	0300		USA, EWTN/WEWN Irondale, AL			11520me
0200	0300		USA, FBN/WTJC Newport NC			9370na
0200	0300		USA, KJES Vado NM	7555na		
0200	0300		USA, WBCQ Monticello ME	5110na		7415am
			9330am			
0200	0300	twhfa	USA, WHRI Cypress Creek SC			5875am
			7315na	7385na		
0200	0300		USA, WINB Red Lion PA	9265am		
0200	0300		USA, WRNO New Orleans LA			7505am
0200	0300		USA, WTWW Lebanon TN	5755va		
0200	0300		USA, WWCR Nashville TN	3215na		4840na
			5890na	5935na		
0200	0300		USA, WWRB Manchester TN	3145va		3185va
			5050va			
0200	0300		USA, WYFR/Family Radio Worldwide			5930ca
			5985ca	6885ca	6890ca	7455am
			9505am	9525am		
0215	0230		Nepal, Radio Nepal	5005as		
0215	0300		Uganda, UBC Radio	4975do		
0230	0300		Vietnam, Voice of Vietnam	6175am		
0245	0300	twhfas	Albania, Radio Tirana	6130na		
0245	0300		Australia, HCJB Global Australia			15400as
0250	0300		Vatican City State, Vatican Radio			6040am
			7305am			
0255	0300	Sun	Swaziland, TWR Swaziland	3200af		

0300 UTC - 10PM EST / 9PM CST / 7PM PST

0300	0320		Vatican City State, Vatican Radio			15460as
0300	0325	Sun	Swaziland, TWR Swaziland	3200af		
0300	0330		Egypt, Radio Cairo	6270na		
0300	0330		Myanmar, Myanmar Radio	9730do		
0300	0330		Philippines, PBS/ Radyo Pilipinas			11880me
			15285me	17710me		
0300	0330		Sri Lanka, SLBC	6005as	9770as	15745as
0300	0330		USA, KJES Vado NM	7555na		
0300	0330		Vatican City State, Vatican Radio			7360af
			9660af			
0300	0330	DRM	Vatican City State, Vatican Radio			9660af
0300	0357		North Korea, Voice of Korea	7220as		9345as
			9730as			
0300	0358		Germany, Deutsche Welle	11695as		
0300	0400		Anguilla, Worldwide Univ Network			6090am
0300	0400		Australia, ABC NT Alice Springs			4835do
0300	0400		Australia, ABC NT Katherine	5025do		
0300	0400		Australia, ABC NT Tennant Creek			4910do
0300	0400		Australia, Radio Australia	9660pa		12080pa
			13690pa	15240as	15415as	15515as
			17750as	21725va		
0300	0400		Bahrain, Radio Bahrain	6010me		
0300	0400		Bulgaria, Radio Bulgaria	5900na		7400na
0300	0400	twhfas	Canada, CBC NQ SW Service			9625na
0300	0400		Canada, CFRX Toronto ON	6070na		
0300	0400		Canada, CFVP Calgary AB	6030na		
0300	0400		Canada, CKZN St Johns NF	6160na		
0300	0400		Canada, CKZU Vancouver BC			6160na
0300	0400		China, China Radio International			9690na
			9790na	11770as	15110as	15120eu
			15785as			
0300	0400		Cuba, Radio Havana Cuba	6000na		6050na
0300	0400	vl	Guyana, Voice of Guyana	3290va		
0300	0400		Malaysia, RTM/Traxx FM	7295do		
0300	0400		New Zealand, Radio NZ International			15720pa
0300	0400	DRM	New Zealand, Radio NZ International			13730pa
0300	0400		Oman, Radio Sultanate of Oman			15355af
0300	0400	smtwhf	Palau, T8WH/WHRI/Sound of Hope Radio			
			15680as			
0300	0400		Russia, Voice of Russia	6240na		7250na
			7440na	12030na	12040na	13735na
0300	0400		Slovakia, NEXUS/IRRS SW	9670af		
0300	0400		South Africa, Channel Africa	3345af		6120af
0300	0400		Taiwan, Radio Taiwan International			6875na
			15320as			
0300	0400		Uganda, UBC Radio	4975do		
0300	0400		UK, BBC World Service	3255af		5940va
			6100af	6145af	6190af	7255af
			7445af	9410as	9460af	
0300	0400		Ukraine, Radio Ukraine International			7440na
0300	0400		USA, American Forces Network			4319usb
			5446usb	5765usb	7812usb	12133usb
			12759usb	13362usb		
0300	0400		USA, EWTN/WEWN Irondale, AL			11520me
0300	0400		USA, FBN/WTJC Newport NC			9370na
0300	0400		USA, Voice of America	4930af		6080af
			9885af	15580af		
0300	0400		USA, WBCQ Monticello ME	5110na		7415am
			9330am			
0300	0400	Sat	USA, WHRI Cypress Creek SC			7590na
0300	0400	twhfa	USA, WHRI Cypress Creek SC			7315na
0300	0400		USA, WINB Red Lion PA	9265am		
0300	0400		USA, WRNO New Orleans LA			7505am
0300	0400		USA, WTWW Lebanon TN	5755va		
0300	0400		USA, WWCR Nashville TN	3215na		4840na
			5890na	5935na		
0300	0400		USA, WWRB Manchester TN	3145va		3185va
			5050va			
0300	0400		USA, WYFR/Family Radio Worldwide			7455am
			9505am	9930ca	9985ca	
0330	0400	twhfas	Albania, Radio Tirana	6100na		
0330	0400	Sun	Sri Lanka, SLBC	6005as	9770as	15745as
0330	0400		UK, BBC World Service	11860af		
0330	0400		Vietnam, Voice of Vietnam	6175am		
0345	0400	vl/Sat/Sun	Uganda, UBC Radio	4975do		

0400 UTC - 11PM EST / 10PM CST / 8PM PST

0400	0430	mtwhf	France, Radio France Internationale			7315af
			9805af			
0400	0430	Sun	Sri Lanka, SLBC	6005as	9770as	15745as
0400	0455		Turkey, Voice of Turkey	7240as		9655va
0400	0457		Germany, Deutsche Welle	5905eu		5945eu
			6180af	9450af	15600af	
0400	0458		New Zealand, Radio NZ International			15720pa
0400	0458	DRM	New Zealand, Radio NZ International			13730pa
0400	0500		Anguilla, Worldwide Univ Network			6090am
0400	0500		Australia, ABC NT Alice Springs			4835do
0400	0500		Australia, ABC NT Katherine	5025do		
0400	0500		Australia, ABC NT Tennant Creek			4910do
0400	0500		Australia, Radio Australia	9590pa		12080pa
			13690pa	15240as	15515as	21725va
0400	0500		Bahrain, Radio Bahrain	6010me		
0400	0500	twhfas	Canada, CBC NQ SW Service			9625na
0400	0500		Canada, CFRX Toronto ON	6070na		
0400	0500		Canada, CKZN St Johns NF	6160na		
0400	0500		Canada, CKZU Vancouver BC			6160na
0400	0500		China, China Radio International			6020na
			6080na	13750as	15120eu	15785as
			17730af	17855af		
0400	0500		Cuba, Radio Havana Cuba	6000na		6050na
0400	0500	vl	Guyana, Voice of Guyana	3290va		
0400	0500		Malaysia, RTM/Traxx FM	7295do		
0400	0500	Sun	Palau, T8WH/WHRI/Sound of Hope Radio			
			15680as			
0400	0500		Romania, Radio Romania International			6130na
			7305na	9690as	11895as	
0400	0500		Russia, Voice of Russia	6240na		12030na
			12040na	13735naq		
0400	0500	DRM	Russia, Voice of Russia	15735as		
0400	0500		Slovakia, NEXUS/IRRS SW	9670af		
0400	0500		South Africa, Channel Africa	7230af		
0400	0500		Sri Lanka, SLBC	6005as	9770as	15745as
0400	0500		Uganda, UBC Radio	4975do		
0400	0500		UK, BBC World Service	3255af		6055af
			6190af	7255af	9410as	9460af
			11860af			
0400	0500		USA, American Forces Network			4319usb
			5446usb	5765usb	7812usb	12133usb
			12759usb	13362usb		
0400	0500		USA, EWTN/WEWN Irondale, AL			11520me
0400	0500		USA, FBN/WTJC Newport NC			9370na
0400	0500		USA, Voice of America	4930af		4960af
			6080af	9885af	15580af	
0400	0500		USA, WBCQ Monticello ME	5110na		7415am
			9330am			
0400	0500	twhfa	USA, WHRI Cypress Creek SC			7315na
0400	0500	Sat	USA, WHRI Cypress Creek SC			9640af
0400	0500		USA, WRNO New Orleans LA			7505am
0400	0500		USA, WTWW Lebanon TN	5755va		
0400	0500		USA, WWCR Nashville TN	3215na		4840na
			5890na	5935na		
0400	0500		USA, WWRB Manchester TN	3145va		3185va
			5050va			
0400	0500		USA, WYFR/Family Radio Worldwide			5950am
			7455am	9505am	9680am	9715am

0400	0500		Zambia, CVC/1 Africa	9430af		
0430	0500	twhfas	Albania, Radio Tirana	6100na		
0430	0500		Australia, Radio Australia	15415as		
0430	0500	mtwhf	Swaziland, TWR Swaziland	3200af	4775af	
0455	0500		Nigeria, Voice of Nigeria/External Service 15120eu			
0459	0500		New Zealand, Radio NZ International	11725pa		
0459	0500	DRM	New Zealand, Radio NZ International	11675pa		

0500 UTC - 12AM EST / 11PM CST / 9PM PST

0500	0507	twhfas	Canada, CBC NQ SW Service	9625na		
0500	0527		Germany, Deutsche Welle	9755af		
0500	0530		China, CNR-11/Holy Tibet	9530do	11685do	15570do
0500	0530	mtwhf	France, Radio France Internationale	9805af	11995af	
0500	0530		Germany, Deutsche Welle	6130af	6155af	6180af 12045af
0500	0530		Japan, NHK World/Radio Japan	5975eu	6110na	9770af 15205as 17810as
0500	0530		Vatican City State, Vatican Radio	7360af	9660af	11625af
0500	0555		Sri Lanka, SLBC	6005as	9770as	15745as
0500	0600		Anguilla, Worldwide Univ Network	6090am		
0500	0600		Australia, ABC NT Alice Springs	4835do		
0500	0600		Australia, ABC NT Katherine	5025do		
0500	0600		Australia, ABC NT Tennant Creek	4910do		
0500	0600		Australia, Radio Australia	9590pa	12080pa	13630as 15160pa 15240pa 17750as
0500	0600		Bahrain, Radio Bahrain	6010me		
0500	0600		Bhutan, Bhutan Broadcasting Service	6035as		
0500	0600		Canada, CFRX Toronto ON	6070na		
0500	0600		Canada, CKZN St Johns NF	6160na		
0500	0600		Canada, CKZU Vancouver BC	6160na		
0500	0600		China, China Radio International	6020na	6190na 11710me 11895as 15350as 15465as 17505af 17540as 17730af 17855af	
0500	0600		Cuba, Radio Havana Cuba	6000na	6010na	6050na 6060na 6150na
0500	0600	mtwhf	Equatorial Guinea, Radio African Network/Radio Africa # 2	15190af		
0500	0600	Sat/Sun	Equatorial Guinea, Radio African Network/Radio East Africa	15190af		
0500	0600	vl	Guyana, Voice of Guyana	3290va		
0500	0600		Liberia, Star Radio	3960do	4025al	
0500	0600		Malaysia, RTM/Traxx FM	7295do		
0500	0600		New Zealand, Radio NZ International	11725pa		
0500	0600	DRM	New Zealand, Radio NZ International	11675pa		
0500	0600		Nigeria, Voice of Nigeria/External Service 15120eu			
0500	0600		Russia, Voice of Russia	12030na		
0500	0600	DRM	Russia, Voice of Russia	15735as		
0500	0600		Slovakia, NEXUS/IRRS SW	9670af		
0500	0600		South Africa, Channel Africa	7230af		
0500	0600		Swaziland, TWR Swaziland	4775af	9500af	
0500	0600		Taiwan, Radio Taiwan International	6875na		
0500	0600		Uganda, UBC Radio	4975do		
0500	0600		UK, BBC World Service	3255af	3955eu	5875eu 6005af 6190af 7255af 9410as 11770af 11860af
0500	0600		USA, American Forces Network	4319usb	5446usb 5765usb 7812usb 12133usb 12759usb 13362usb	
0500	0600		USA, EWTN/WEWN Irondale, AL	11520af		
0500	0600		USA, FBN/WTJC Newport NC	9370na		
0500	0600		USA, Voice of America	4930af	6080af	9885af 15580af
0500	0600	Sun	USA, WHRI Cypress Creek SC	11565pa		
0500	0600		USA, WRNO New Orleans LA	7505am		
0500	0600		USA, WTWW Lebanon TN	5755va		
0500	0600		USA, WWCR Nashville TN	3215na	4840na	5890na
0500	0600		USA, WWRB Manchester TN	3185va		
0500	0600		USA, WYFR/Family Radio Worldwide	5950am		9680am
0500	0600		Zambia, CVC/1 Africa	9430af		
0500	0600		Zambia, Radio Christian Voice	6065af		
0502	0600		Swaziland, TWR Swaziland	6120af		
0505	0600		Russia, Voice of Russia	9855na		
0515	0530		Rwanda, Radio Rwanda	6055do		
0530	0600	Sun	Palau, T8WH/WHRI/Sound of Hope Radio 15680as			
0530	0600		Thailand, Radio Thailand World Service	11730va		

0600 UTC - 1AM EST / 12AM CST / 10PM PST

0600	0620	mtwhfa	Vatican City State, Vatican Radio	4005eu	7250eu	
0600	0629		Germany, Deutsche Welle	5945af	7240af	15205af
0600	0630	Sat/Sun	Australia, Radio Australia	15290pa	15415as	
0600	0630		China, Xizang PBS/Holy Tibet	4905do	4920do	6200do
0600	0630	mtwhf	France, Radio France Internationale	7315af	13680af 15160af	
0600	0630	mtwhfa	Vatican City State, Vatican Radio	5965eu		
0600	0645	mtwhf	South Africa, TWR Africa	11640af		
0600	0658		New Zealand, Radio NZ International	11725pa		
0600	0658	DRM	New Zealand, Radio NZ International	11675pa		
0600	0700		Anguilla, Worldwide Univ Network	6090am		
0600	0700		Australia, ABC NT Alice Springs	4835do		
0600	0700		Australia, ABC NT Katherine	5025do		
0600	0700		Australia, ABC NT Tennant Creek	4910do		
0600	0700		Australia, Radio Australia	9590pa	12080pa	13630as 13690pa 15160pa 15240pa 17750as
0600	0700		Bahrain, Radio Bahrain	6010me		
0600	0700		Canada, CFRX Toronto ON	6070na		
0600	0700		Canada, CFVP Calgary AB	6030na		
0600	0700		Canada, CKZN St Johns NF	6160na		
0600	0700		Canada, CKZU Vancouver BC	6160na		
0600	0700		China, China Radio International	11710me	11870af 11895as 13660as 15140af 15350as 15465as 17505af 17540as	
0600	0700		Cuba, Radio Havana Cuba	6000na	6010na	6050na 6060na 6150na
0600	0700	mtwhf	Equatorial Guinea, Radio African Network/Radio Africa # 2	15190af		
0600	0700	Sat/Sun	Equatorial Guinea, Radio African Network/Radio East Africa	15190af		
0600	0700		Greece, Voice of Greece	11645eu		
0600	0700	vl	Guyana, Voice of Guyana	3290va		
0600	0700		Liberia, Star Radio	3960do	4025al	
0600	0700		Malaysia, RTM/Traxx FM	7295do		
0600	0700		Malaysia, RTM/Voice of Malaysia	6175as	9750as 15295as	
0600	0700		Nigeria, Voice of Nigeria/External Service 15120eu			
0600	0700	Sun	Palau, T8WH/WHRI/Sound of Hope Radio 15680as			
0600	0700		Russia, Voice of Russia	9855na	12030na	
0600	0700		South Africa, Channel Africa	7230af	15255af	
0600	0700		Swaziland, TWR Swaziland	4775af	6120af	9500af
0600	0700		Uganda, UBC Radio	4975do		
0600	0700		UK, BBC World Service	3995eu	5875eu	6005af 6190af 9410af 9860af 11760as 11770af
0600	0700		USA, American Forces Network	4319usb	5446usb 5765usb 7812usb 12133usb 12759usb 13362usb	
0600	0700		USA, EWTN/WEWN Irondale, AL	11520af		
0600	0700		USA, FBN/WTJC Newport NC	9370na		
0600	0700		USA, Voice of America	6080af	9885af	15580af
0600	0700		USA, WRNO New Orleans LA	7505am		
0600	0700		USA, WTWW Lebanon TN	5755va		
0600	0700		USA, WWCR Nashville TN	3215na	4840na	5890na 5935na
0600	0700		USA, WWRB Manchester TN	3185va		
0600	0700		USA, WYFR/Family Radio Worldwide	5745va	11530va	6000ca 9680am 9885af
0600	0700		Zambia, CVC/1 Africa	13590af		
0600	0700		Zambia, Radio Christian Voice	6065af		
0600	615	Sat/Sun	South Africa, TWR Africa	11640af		
0630	0700		Australia, Radio Australia	15415as		
0630	0700		Romania, Radio Romania International	7370eu	17780pa 21600pa	
0630	0700	DRM	Romania, Radio Romania International	6020eu		
0630	0700		Vatican City State, Vatican Radio	7360af	9660af 11625af	
0659	0700		New Zealand, Radio NZ International	9765pa		
0659	0700	DRM	New Zealand, Radio NZ International	11675pa		

0700 UTC - 2AM EST / 1AM CST / 11PM PST

0700	0730	mtwhf	France, Radio France Internationale			11725af
0700	0730		Myanmar, Myanmar Radio	9730do		
0700	0758		New Zealand, Radio NZ International			9765pa
0700	0758	DRM	New Zealand, Radio NZ International			11675pa
0700	0800		Anguilla, Worldwide Univ Network			6090am
0700	0800		Australia, ABC NT Alice Springs			4835do
0700	0800		Australia, ABC NT Katherine	5025do		
0700	0800		Australia, ABC NT Tennant Creek			4910do
0700	0800		Australia, Radio Australia	9475pa	9590pa	9710pa 11945pa 12080pa 15160pa 15240as
0700	0800		Bahrain, Radio Bahrain	6010me		
0700	0800	m/DRM	Belgium, TDP Radio	6015eu		
0700	0800		Canada, CFRX Toronto ON	6070na		
0700	0800		Canada, CFVP Calgary AB	6030na		
0700	0800		Canada, CKZN St Johns NF	6160na		
0700	0800		Canada, CKZU Vancouver BC			6160na
0700	0800		China, China Radio International			11895as 13660as 13710eu 15125me 15350as 17710as
0700	0800	mtwhf	Equatorial Guinea, Radio African Network/Radio Africa # 2	15190af		
0700	0800	Sat/Sun	Equatorial Guinea, Radio African Network/Radio East Africa	15190af		
0700	0800	vl	Guyana, Voice of Guyana	3290va		
0700	0800		Liberia, Star Radio	3960do	4025al	
0700	0800		Malaysia, RTM/Traxx FM	7295do		
0700	0800		Malaysia, RTM/Voice of Malaysia			6175as 9750as 15295as
0700	0800		Myanmar, Myanmar Radio	9730do		
0700	0800		Russia, Voice of Russia	17665pa	17805pa	
0700	0800	DRM	Russia, Voice of Russia	11635eu		
0700	0800		Swaziland, TWR Swaziland	4775af	6120af	9500af
0700	0800		Uganda, UBC Radio	4975do		
0700	0800		UK, BBC World Service	3955eu	6190af	9860af 11760me 11770af
0700	0800	DRM	UK, BBC World Service	5875eu		
0700	0800		USA, American Forces Network			4319usb 5446usb 5765usb 7812usb 12133usb 12759usb 13362usb
0700	0800		USA, EWTN/WEWN Irondale, AL			11520af
0700	0800		USA, FBN/WTJC Newport NC			9370na
0700	0800	Sun	USA, WHRI Cypress Creek SC			11565pa
0700	0800		USA, WRNO New Orleans LA			7505am
0700	0800		USA, WTWW Lebanon TN	5755va		
0700	0800		USA, WWCR Nashville TN	3215na	4840na	5890na 5935na
0700	0800		USA, WWRB Manchester TN	3185va		
0700	0800		USA, WYFR/Family Radio Worldwide			5950am 5745va 6875am 7455am 9495ca 11580af
0700	0800		Zambia, CVC/1 Africa	13590af		
0700	0800		Zambia, Radio Christian Voice			6065af
0730	0745	mtwhf	Vatican City State, Vatican Radio			5965eu 7250eu 9645eu
0730	0745	mtwhfa	Vatican City State, Vatican Radio			4005eu 11740eu 15595eu
0730	0800		Australia, HCJB Global Australia			11750as
0730	0800		Bulgaria, Radio Bulgaria	5900eu		7400eu
0730	0800		Clandestine, Cotton Tree News			15220af
0745	0800	Sun	Germany, TWR Europe	6105eu		
0745	0800	Sun	Monaco, TWR Europe	9800eu		
0759	0800	DRM	New Zealand, Radio NZ International			9870pa

0800 UTC - 3AM EST / 2AM CST / 12AM PST

0800	0830		Australia, ABC NT Alice Springs			4835do
0800	0830		Australia, ABC NT Katherine	5025do		
0800	0830		Australia, ABC NT Tennant Creek			4910do
0800	0830		Myanmar, Myanmar Radio	9730do		
0800	0830	Sun	UK, Bible Voice Broadcasting Network			7220eu
0800	0845	Sat	UK, Bible Voice Broadcasting Network			7220eu
0800	0850	mtwhf	Germany, TWR Europe	6105eu		
0800	0850	mtwhf	Monaco, TWR Europe	9800eu		
0800	0900		Anguilla, Worldwide Univ Network			6090am
0800	0900		Australia, HCJB Global Australia			11750pa
0800	0900		Australia, Radio Australia	5995as	9475pa	9485pa 9580va 9590pa 11945pa 12080pa 13630pa
0800	0900		Bahrain, Radio Bahrain	6010me		
0800	0900	t/DRM	Belgium, TDP Radio	6015eu		
0800	0900		Bhutan, Bhutan Broadcasting Service			6035as
0800	0900		Canada, CFRX Toronto ON	6070na		
0800	0900		Canada, CFVP Calgary AB	6030na		
0800	0900		Canada, CKZN St Johns NF	6160na		
0800	0900		Canada, CKZU Vancouver BC			6160na
0800	0900		China, China Radio International			11620as 11895as 13710eu 15350as 15465as 15625me 17540as
0800	0900	mtwhf	Equatorial Guinea, Radio African Network/Radio Africa # 2	15190af		
0800	0900	Sat/Sun	Equatorial Guinea, Radio African Network/Radio East Africa	15190af		
0800	0900		Greece, Voice of Greece	11645eu		
0800	0900	vl	Guyana, Voice of Guyana	3290va		
0800	0900		Liberia, Star Radio	3960do	4025al	
0800	0900		Malaysia, RTM/Traxx FM	7295do		
0800	0900		Malaysia, RTM/Voice of Malaysia			6175as 9750as 15295as
0800	0900		New Zealand, Radio NZ International			9765pa
0800	0900	DRM	New Zealand, Radio NZ International			9870pa
0800	0900	Sun	Palau, T8WH/WHRI/Sound of Hope Radio			9930as
0800	0900		Russia, Voice of Russia	17665pa	17805pa	
0800	0900	DRM	Russia, Voice of Russia	11635eu		
0800	0900	Sun	South Africa, SA Radio League			7205af 17570af
0800	0900		South Korea, KBS World Radio			9570as
0800	0900		Uganda, UBC Radio	4975do		
0800	0900		UK, BBC World Service	5875eu	6190af	9860af 11760me
0800	0900	DRM	UK, BBC World Service	9610eu		
0800	0900		Ukraine, Radio Ukraine International			9410eu
0800	0900		USA, American Forces Network			4319usb 5446usb 5765usb 7812usb 12133usb 12759usb 13362usb
0800	0900		USA, EWTN/WEWN Irondale, AL			11520af
0800	0900		USA, FBN/WTJC Newport NC			9370na
0800	0900		USA, KNLS Anchor Point AK	7355as		
0800	0900	smtwhf	USA, WHRI Cypress Creek SC			11565pa
0800	0900		USA, WRNO New Orleans LA			7505am
0800	0900		USA, WTWW Lebanon TN	5755va		
0800	0900		USA, WWCR Nashville TN	3215na	4840na	5890na 5935na
0800	0900		USA, WWRB Manchester TN	3185va		
0800	0900		USA, WYFR/Family Radio Worldwide			5950am 6875am 7455am 11580af
0800	0900		Zambia, CVC/1 Africa	13590af		
0800	0900		Zambia, Radio Christian Voice			6065af
0815	0825		Nepal, Radio Nepal	5005as		
0815	0850	Sat	Germany, TWR Europe	6105eu		
0815	0850	Sat	Monaco, TWR Europe	9800eu		
0815	0900	mtwhf	Palau, T8WH/WHRI/Sound of Hope Radio			9930as
0820	0900	smtwhf	Guam, KTWR/TWR	15170as		
0830	0900		Australia, ABC NT Alice Springs			2310do
0830	0900		Australia, ABC NT Katherine	2485do		
0830	0900		Australia, ABC NT Tennant Creek			2325do
0830	0900	mtwhfa	Guam, KTWR/TWR	11840pa		

0900 UTC - 4AM EST / 3AM CST / 1AM PST

0900	0910	mtwhfa	Guam, KTWR/TWR	11840pa		
0900	0930		Australia, HCJB Global Australia			11750pa
0900	0930		Palau, T8WH/WHRI/Sound of Hope Radio			9930as
0900	0958		Germany, Deutsche Welle	21780as		
0900	1000		Anguilla, Worldwide Univ Network			6090am
0900	1000		Australia, ABC NT Alice Springs			2310do
0900	1000		Australia, ABC NT Katherine	2485do		
0900	1000		Australia, ABC NT Tennant Creek			2325do
0900	1000		Australia, Radio Australia	9475pa	9485pa	9580va 9590pa 11945pa 12080pa 13630pa
0900	1000		Bahrain, Radio Bahrain	6010me		
0900	1000	w/DRM	Belgium, TDP Radio	6015eu		
0900	1000		Canada, CFRX Toronto ON	6070na		
0900	1000		Canada, CFVP Calgary AB	6030na		
0900	1000		Canada, CKZN St Johns NF	6160na		
0900	1000		Canada, CKZU Vancouver BC			6160na
0900	1000		China, China Radio International			11620as 13790pa 15210as 15270eu 15350as 17490eu 17570eu 17750as

0900	1000	2nd Sun	Germany, Blue Star Radio	6140eu		
0900	1000		Germany, Deutsche Welle	17710as		
0900	1000	vl	Guyana, Voice of Guyana	3290va		
0900	1000		Malaysia, RTM/Traxx FM	7295do		
0900	1000		Malaysia, RTM/Voice of Malaysia	6175as	9750as	15295as
0900	1000		New Zealand, Radio NZ International	9765pa		
0900	1000	DRM	New Zealand, Radio NZ International	9870pa		
0900	1000		Nigeria, Voice of Nigeria/External Service 9690af			
0900	1000		Russia, Voice of Russia	17665pa	17805pa	
0900	1000	3rd Sat	Slovakia, NEXUS/IRRS SW	9510va		
0900	1000		Tajikistan, Voice of Tajik/External Service	7245va		
0900	1000		Uganda, UBC Radio	4975do		
0900	1000		UK, BBC World Service	6195as	9740as	9860af
			11760me	11895as		
0900	1000		USA, American Forces Network	4319usb	5446usb	5765usb
			7812usb	12133usb	12759usb	13362usb
0900	1000		USA, EWTN/WEWN Irondale, AL	9390as		
0900	1000		USA, FBN/WTJC Newport NC	9370na		
0900	1000	Sun	USA, WHRI Cypress Creek SC	11565pa		
0900	1000		USA, WRNO New Orleans LA	7505am		
0900	1000		USA, WTWW Lebanon TN	5755va		
0900	1000		USA, WWCR Nashville TN	3215na	4840na	5935na
0900	1000		USA, WWRB Manchester TN	3185va		
0900	1000		USA, WYFR/Family Radio Worldwide	5950am	6875am	7455am
			9465as			
0900	1000		Zambia, CVC/1 Africa	13590af		
0900	1000		Zambia, Radio Christian Voice	6065af		
0930	0945	mwhf	Palau, T8WH/WHRI/Sound of Hope Radio 9930as			
0930	1000	ta	Palau, T8WH/WHRI/Sound of Hope Radio 9930as			
0930	1000		Saudi Arabia, BSKSA/Saudi Radio	15250af		
0945	1000	smwf	Palau, T8WH/WHRI/Sound of Hope Radio 9930as			

1000 UTC - 5AM EST / 4AM CST / 2AM PST

1000	1015	f	Palau, T8WH/WHRI/Sound of Hope Radio 9930as			
1000	1030	Sat/Sun/DRM	Bulgaria, Radio Bulgaria/Euranet 11900eu			
1000	1030		Japan, NHK World/Radio Japan	9605as	9625pa	9840pa
			11780as			
1000	1030ash		Palau, T8WH/WHRI/Sound of Hope Radio 15725as			
1000	1030	fa	Philippines, FEBC 15325as			
1000	1030		Vietnam, Voice of Vietnam	9840as	12020as	
1000	1057		Netherlands, R Netherlands Worldwide	9720as	12065as	
1000	1057		North Korea, Voice of Korea	6185as	6285sa	9335sa
			9850as			
1000	1058		New Zealand, Radio NZ International	9765pa		
1000	1058	DRM	New Zealand, Radio NZ International	9870pa		
1000	1100		Anguilla, Worldwide Univ Network	11775am		
1000	1100		Australia, ABC NT Alice Springs	2310do		
1000	1100		Australia, ABC NT Katherine	2485do		
1000	1100		Australia, ABC NT Tennant Creek	2325do		
1000	1100		Australia, Radio Australia	6140as	9475pa	9485va
			9580pa	9590pa	11945pa	12080pa
1000	1100		Bahrain, Radio Bahrain	6010me		
1000	1100	h/DRM	Belgium, TDP Radio	6015eu		
1000	1100		Canada, CFRX Toronto ON	6070na		
1000	1100		Canada, CFVP Calgary AB	6030na		
1000	1100		Canada, CKZN St Johns NF	6160na		
1000	1100		Canada, CKZU Vancouver BC	6160na		
1000	1100		China, China Radio International	6040na	11610as	11635eu
			13590as	13620as	13720as	13790pa
			15190as	15350as	17490eu	
1000	1100	3rd Sun	Germany, European Music Radio	6140eu		
1000	1100	4th Sun	Germany, Radio Gloria International	6140eu		
1000	1100		India, All India Radio	7270as	13710pa	15235as
			15260as	17510pa	17800as	17895pa
			13695al	15020al		
1000	1100		Indonesia, Voice of Indonesia	9525va	11785al	
1000	1100		Malaysia, RTM/Traxx FM	7295do		
1000	1100		Nigeria, Voice of Nigeria/External Service 9690af			
1000	1100		Russia, Voice of Russia	7205as	17665pa	17805pa
1000	1100		Saudi Arabia, BSKSA/Saudi Radio	15250af	15470af	
1000	1100		Uganda, UBC Radio	4975do		
1000	1100		UK, BBC World Service	6195as	9605as	9740as
			9860af	11760me	11895as	
1000	1100		USA, American Forces Network	4319usb	5446usb	5765usb
			7812usb	12133usb	12759usb	13362usb
1000	1100		USA, EWTN/WEWN Irondale, AL	9390as		
1000	1100		USA, FBN/WTJC Newport NC	9370na		
1000	1100		USA, KNLS Anchor Point AK	7355as		
1000	1100	Sun	USA, WHRI Cypress Creek SC	11565pa		
1000	1100		USA, WRNO New Orleans LA	7505am		
1000	1100		USA, WTWW Lebanon TN	5755va		
1000	1100		USA, WWCR Nashville TN	4840na	5890na	5935na
			9985na			
1000	1100		USA, WWRB Manchester TN	3185va		
1000	1100		USA, WYFR/Family Radio Worldwide	5950am	6890am	6895na
			7455am	9460af	9465as	
1000	1100		Zambia, CVC/1 Africa	13590af		
1000	1100		Zambia, Radio Christian Voice	6065af		
1015	1100	fs	Palau, T8WH/WHRI/Sound of Hope Radio 9930as			
1030	1045	Sat	Palau, T8WH/WHRI/Sound of Hope Radio 9930as	15725as		
1030	1100		Iran, VOIRI/IRIB	15460as	17630as	
1030	1100		Mongolia, Voice of Mongolia	12085as		
1030	1100	Sun	Slovakia, NEXUS/IRRS SW	9510va		
1045	1100	mh	Palau, T8WH/WHRI/Sound of Hope Radio 15725as			
1045	1100	ha	Palau, T8WH/WHRI/Sound of Hope Radio 9930as			
1059	1100		New Zealand, Radio NZ International	13660pa		
1059	1100	DRM	New Zealand, Radio NZ International	9870pa		

1100 UTC - 6AM EST / 5AM CST / 3AM PST

1100	1127		Iran, VOIRI/IRIB	15460as	17630as	
1100	1130	Sat/DRM	South Korea, KBS World Radio	9760eu		
1100	1130	Sun	Vatican City State, Vatican Radio	7250eu		
1100	1130		Vietnam, Voice of Vietnam	7280as		
1100	1158	DRM	New Zealand, Radio NZ International	9870pa		
1100	1200		Anguilla, Worldwide Univ Network	11775am		
1100	1200		Australia, ABC NT Alice Springs	2310do		
1100	1200		Australia, ABC NT Katherine	2485do		
1100	1200		Australia, ABC NT Tennant Creek	2325do		
1100	1200		Australia, Radio Australia	5995as	6020pa	6140as
			9475pa	9485pa	9560va	9580va
			9590pa	11945pa		
1100	1200	DRM	Australia, Radio Australia	12080as		
1100	1200		Bahrain, Radio Bahrain	6010me		
1100	1200	f/DRM	Belgium, TDP Radio	6015eu		
1100	1200	Sat/Sun	Canada, CBC NQ SW Service	9625na		
1100	1200		Canada, CFRX Toronto ON	6070na		
1100	1200		Canada, CFVP Calgary AB	6030na		
1100	1200		Canada, CKZN St Johns NF	6160na		
1100	1200		Canada, CKZU Vancouver BC	6160na		
1100	1200		China, China Radio International	5955as	6040na	11650as
			11660as	11750na	11795as	13590as
			13645as	13650eu	13720as	17490eu
1100	1200		Malaysia, RTM/Traxx FM	7295do		
1100	1200		New Zealand, Radio NZ International	13660pa		
1100	1200		Nigeria, Voice of Nigeria/External Service 9690af			
1100	1200		Russia, Voice of Russia	7205as		
1100	1200		Saudi Arabia, BSKSA/Saudi Radio	15250af	15470af	
1100	1200	Sun	Slovakia, NEXUS/IRRS SW	9510va		
1100	1200		Taiwan, Radio Taiwan International	7445as	11715as	
1100	1200		Uganda, UBC Radio	4975do		
1100	1200		UK, BBC World Service	6195as	9605as	9740as
			9860af	11760me	11895as	
1100	1200		USA, American Forces Network	4319usb	5446usb	5765usb
			7812usb	12133usb	12759usb	13362usb
1100	1200		USA, EWTN/WEWN Irondale, AL	9390as		
1100	1200		USA, FBN/WTJC Newport NC	9370na		
1100	1200		USA, WINB Red Lion PA	9265am		

1100	1200		USA, WRNO New Orleans LA			7505am
1100	1200		USA, WTWW Lebanon TN	5755va		
1100	1200		USA, WWCR Nashville TN	4840na		5890na
			5935na	15285na		
1100	1200		USA, WWRB Manchester TN	3185va		
1100	1200		USA, WYFR/Family Radio Worldwide			6000ca
			6875am	6890na	7300af	7455am
			11725ca	11830am		
1100	1200		Zambia, CVC/1 Africa	13590af		
1100	1200		Zambia, Radio Christian Voice			6065af
1130	1140	f	Vatican City State, Vatican Radio			15595as
			17765as			
1130	1200		Vietnam, Voice of Vietnam	9840as		12020as

1200 UTC - 7AM EST / 6AM CST / 4AM PST

1200	1215		Nepal, Radio Nepal	5005as		
1200	1230		France, Radio France Internationale			21620af
1200	1230		Germany, AWR Europe	15495as		
1200	1230		Japan, NHK World/Radio Japan			6120na
			9625pa	9790eu		
1200	1230	Sun	Palau, T8WH/WHRI/Sound of Hope Radio			
			9930as			
1200	1230		Saudi Arabia, BSKSA/Saudi Radio			15250af
			15470af			
1200	1258		New Zealand, Radio NZ International			13660pa
1200	1300		Anguilla, Worldwide Univ Network			11775am
1200	1300		Australia, ABC NT Alice Springs			2310do
1200	1300		Australia, ABC NT Katherine	2485do		
1200	1300		Australia, ABC NT Tennant Creek			2325do
1200	1300		Australia, Radio Australia	6020pa		6140as
			9475pa	9485pa	9560va	9580va
			9590pa	11945pa		
1200	1300	DRM	Australia, Radio Australia	5995pa		
1200	1300		Bahrain, Radio Bahrain	6010me		
1200	1300	Sat/ SRM	Belgium, TDP Radio	6015eu		
1200	1300	Sat/Sun	Canada, CBC NQ SW Service			9625na
1200	1300		Canada, CFRX Toronto ON	6070na		
1200	1300		Canada, CFVP Calgary AB	6030na		
1200	1300		Canada, CKZN St Johns NF	6160na		
1200	1300		Canada, CKZU Vancouver BC			6160na
1200	1300		China, China Radio International			5955as
			9460as	9660as	9730as	9760pa
			11650as	11660as	11690me	11760pa
			11980as	13645as	13650eu	13790eu
			17490eu			
1200	1300	mtwhf	Ethiopia, Radio Ethiopia/National Service			
			5990do	7110do	9705do	
1200	1300		Japan, NHK World/Radio Japan			9695as
1200	1300		Malaysia, RTM/Traxx FM	7295do		
1200	1300		Nigeria, Voice of Nigeria/External Service			
			9690af			
1200	1300	Sat/Sun	Palau, T8WH/WHRI/Sound of Hope Radio			
			9930as			
1200	1300		Romania, Radio Romania International			11970eu
			15430eu	15430af	17765af	
1200	1300	DRM	Russia, Voice of Russia	7340as		
1200	1300		Russia, Voice of Russia	7350as		9695as
			11660as			
1200	1300	Sun	Slovakia, NEXUS/IRRS SW	9510va		
1200	1300		South Korea, KBS World Radio			9650na
1200	1300		Uganda, UBC Radio	4975do		
1200	1300		UK, BBC World Service	5875as		6190af
			6195as	9605as	9740as	9860af
			11760me			
1200	1300		United States, Overcomer Ministries			15320af
1200	1300		USA, American Forces Network			4319usb
			5446usb	5765usb	7812usb	12133usb
			12759usb	13362usb		
1200	1300		USA, EWTN/WEWN Irondale, AL			15610me
1200	1300		USA, FBN/WTJC Newport NC			9370na
1200	1300		USA, KNLS Anchor Point AK	7355as		9655as
1200	1300		USA, Voice of America	7575va		9640va
			11700va	11750va		
1200	1300	mtwhf	USA, WHRI Cypress Creek SC			7385na
1200	1300		USA, WINB Red Lion PA	9265am		
1200	1300		USA, WRNO New Orleans LA			7505am
1200	1300		USA, WTWW Lebanon TN	9479va		
1200	1300		USA, WWCR Nashville TN	4840af		5935na
			9980na	15825na		
1200	1300		USA, WWRB Manchester TN	3185va		
1200	1300		USA, WYFR/Family Radio Worldwide			6890am
			7455am	11530ca	11970am	17545ca
1200	1300		Zambia, CVC/1 Africa	13590af		
1200	1300		Zambia, Radio Christian Voice			6065af
1215	1300		Egypt, Radio Cairo	17870as		
1215	1300	mtwhf	UK, BBC World Service	9410ca		11860sa
1230	1300	smtwhf	Australia, HCJB Global Australia			15400as
1230	1300		Bangladesh, Bangladesh Betar			7250as
1230	1300		Saudi Arabia, BSKSA/Saudi Radio			15470af
1230	1300		Thailand, Radio Thailand World Service			9720va
1230	1300		Vietnam, Voice of Vietnam	9840as		12020as
1259	1300		New Zealand, Radio NZ International			5950pa

1300 UTC - 8AM EST / 7AM CST / 5AM PST

1300	1330		Australia, HCJB Global Australia			15400as
1300	1330		Egypt, Radio Cairo	17870as		
1300	1330		Japan, NHK World/Radio Japan			9875as
1300	1330		Laos, Lao National Radio	7145as		
1300	1357		North Korea, Voice of Korea		7570eu	9335na
			11710na	12015eu		
1300	1359		Poland, Polskie Radio Warsaw			9460eu
			11860eu			
1300	1400		Anguilla, Worldwide Univ Network			11775am
1300	1400		Australia, ABC NT Alice Springs			2310do
1300	1400		Australia, ABC NT Katherine	2485do		
1300	1400		Australia, Radio Australia	6020pa		9485pa
			9560va	9580va	9590pa	
1300	1400	DRM	Australia, Radio Australia	5995pa		
1300	1400		Bahrain, Radio Bahrain	6010me		
1300	1400	Sun/DRM	Belgium, TDP Radio	6015na		
1300	1400	Sat/Sun	Canada, CBC NQ SW Service			9625na
1300	1400		Canada, CFRX Toronto ON	6070na		
1300	1400		Canada, CFVP Calgary AB	6030na		
1300	1400		Canada, CKZN St Johns NF	6160na		
1300	1400		Canada, CKZU Vancouver BC			6160na
1300	1400		China, China Radio International			5995as
			9570na	9650na	9730as	9765as
			9870as	11660as	11760me	11980as
			13610eu	13755as	15260na	
1300	1400		Germany, Overcomer Ministries			15495af
1300	1400		Indonesia, Voice of Indonesia		9525va	11785al
1300	1400		Malaysia, RTM/Traxx FM	7295do		
1300	1400		New Zealand, Radio NZ International			5950pa
1300	1400		Nigeria, Voice of Nigeria/External Service			
			9690af			
1300	1400		Russia, Voice of Russia	7205as		
1300	1400		South Korea, KBS World Radio			9570as
1300	1400		Tajikistan, Voice of Tajik/External Service			7245va
1300	1400		Uganda, UBC Radio	4975do		
1300	1400		UK, BBC World Service	5875as		6190af
			6195as	9410as	9740as	9860af
			11760me	11805as		
1300	1400		United States, Overcomer Ministries			11860af
			17765af			
1300	1400		USA, American Forces Network			4319usb
			5446usb	5765usb	7812usb	12133usb
			12759usb	13362usb		
1300	1400		USA, EWTN/WEWN Irondale, AL			15610me
1300	1400		USA, FBN/WTJC Newport NC			9370na
1300	1400	Sat/Sun	USA, Voice of America	7575va		9640va
			9760va	11700va		
1300	1400	Sat/Sun	USA, WHRI Cypress Creek SC			9540na
			9840na			
1300	1400		USA, WINB Red Lion PA	13570am		
1300	1400		USA, WRNO New Orleans LA			7505am
1300	1400		USA, WTWW Lebanon TN	9479va		
1300	1400		USA, WWCR Nashville TN	7490af		9980na
			13845na	15825na		
1300	1400		USA, WWRB Manchester TN	3185va		
1300	1400		USA, WYFR/Family Radio Worldwide			5835as
			7455am	11830as	11520as	11560am
			11855am	11970am		
1300	1400		Zambia, CVC/1 Africa	13590af		
1300	1400		Zambia, Radio Christian Voice			6065af
1330	1400	st	Guam, KSDA/AWR	11935as		
1330	1400	mtw	Guam, KSDA/AWR	15660as		
1330	1400		India, All India Radio		9690as	11620as
			13710as			
1330	1400		Turkey, Voice of Turkey		11735as	12035eu
1330	1400		Vietnam, Voice of Vietnam	9840as		12020as
1345	1400	Sun	UK, Bible Voice Broadcasting Network			13365as

1400 UTC - 9AM EST / 8AM CST / 6AM PST

1400	1425	mh	Guam, KTWR/TWR	9975as		
1400	1425		Turkey, Voice of Turkey	11735as	12035eu	
1400	1430		China, CNR-11/Holy Tibet	6010do	7350do	9480do
1400	1430	Sun	Germany, Pan American Broadcasting	13645as		
1400	1430	`	Japan, NHK World/Radio Japan	5955as	9875as	21560af
1400	1430		Serbia, International Radio of Serbia	9505eu		
1400	1430		Thailand, Radio Thailand World Service	9725va		
1400	1430	Sun	United Arab Emirates, FEBA Radio	12045as		
1400	1435	twfas	Guam, KTWR/TWR	9975as		
1400	1500		Anguilla, Worldwide Univ Network	11775am		
1400	1500		Australia, ABC NT Alice Springs	2310do		
1400	1500		Australia, ABC NT Katherine	2485do		
1400	1500		Australia, ABC NT Tennant Creek	2325do		
1400	1500		Australia, Radio Australia	5995pa	6080pa	7240pa 9590pa
1400	1500		Bahrain, Radio Bahrain	6010me		
1400	1500	DRM	Belgium, TDP Radio/Disco Palace	6015eu		
1400	1500		Bhutan, Bhutan Broadcasting Service	6035as		
1400	1500	Sat/Sun	Canada, CBC NQ SW Service	9625na		
1400	1500		Canada, CFRX Toronto ON	6070na		
1400	1500		Canada, CFVP Calgary AB	6030na		
1400	1500		Canada, CKZN St Johns NF	6160na		
1400	1500		Canada, CKZU Vancouver BC	6160na		
1400	1500		China, China Radio International	5955as	9765as	9870as 11665as 11675as 11765eu 13710as 13740na 13790eu 17630as
1400	1500		Equatorial Guinea, Radio African Network/Radio East Africa	15190af		
1400	1500		Equatorial Guinea, Radio African Network/Radio East Africa	15190af		
1400	1500		Germany, Overcomer Ministries	15495af		
1400	1500		India, All India Radio	9690as	11620as	13710as
1400	1500		Libya, LJBC Voice of Africa	17725af	21695af	
1400	1500		Malaysia, RTM/Traxx FM	7295do		
1400	1500		Netherlands, R Netherlands Worldwide	12080as	15595va	
1400	1500		New Zealand, Radio NZ International	5950pa		
1400	1500		Nigeria, Voice of Nigeria/External Service	9690af		
1400	1500		Russia, Voice of Russia	7205as	11660as	
1400	1500	DRM	Russia, Voice of Russia	7340as		
1400	1500		Slovakia, NEXUS/IRRS SW	15710va		
1400	1500		Uganda, UBC Radio	4975do		
1400	1500		UK, BBC World Service	5845as	5875as	6190af 6195as 9410as 9740as 9860af 9915as 11760as
1400	1500		United States, Overcomer Ministries	9460eu	13810me	
1400	1500		USA, American Forces Network	4319usb	5446usb	5765usb 7812usb 12133usb 12759usb 13362usb
1400	1500		USA, EWTN/WEWN Irondale, AL	15610me		
1400	1500		USA, FBN/WTJC Newport NC	9370na		
1400	1500		USA, KJES Vado NM	11715na		
1400	1500		USA, KNLS Anchor Point AK	7355as		
1400	1500		USA, Voice of America	6080af	15580af	17650af 17715af
1400	1500	mtwhf	USA, Voice of America	7575va	9760va	12150va
1400	1500		USA, WBCQ Monticello ME	9330am		
1400	1500	Sun	USA, WHRI Cypress Creek SC	17540af		
1400	1500	Sat	USA, WHRI Cypress Creek SC	9840na		
1400	1500		USA, WINB Red Lion PA	13570am		
1400	1500		USA, WJHR International Milton FL	15550na		
1400	1500		USA, WRNO New Orleans LA	7505am	15590al	
1400	1500		USA, WTWW Lebanon TN	9479na		
1400	1500		USA, WWCR Nashville TN	7490af	9980na	13845na 15825na
1400	1500		USA, WWRB Manchester TN	9385na		
1400	1500		USA, WYFR/Family Radio Worldwide	5835as	9485as	11560am 11565am 11855am 13695am 17760am
1400	1500		Zambia, CVC/1 Africa	13590af		
1400	1500		Zambia, Radio Christian Voice	6065af		
1405	1435	Sat/Sun	UK, Bible Voice Broadcasting Network	6225as		
1415	1430		Nepal, Radio Nepal	5005as		
1415	1445		Germany, Pan American Broadcasting	13645as		
1415	1500	Sat	Palau, T8WH/WHRI/Sound of Hope Radio	9930as		
1415	1500	Sun	UK, Bible Voice Broadcasting Network	13365as		
1425	1455		Swaziland, TWR Swaziland	6025af		
1430	1459		China, CNR-2/Business Radio	6055do	6155do	7245as 7315as 7335as 7375as 9820as
1430	1500		Australia, Radio Australia	9475pa	11825as	
1430	1500		China, China Radio International	7325as	11695as	12110as
1430	1500	Sat	UK, Bible Voice Broadcasting Network	13365as		
1445	1500		Australia, HCJB Global Australia	15340as		

1500 UTC - 10AM EST / 9AM CST / 7AM PST

1500	1510	mtwhfa	Turkmenistan, Turkmen Radiosi	5015eu		
1500	1515	Sun	UK, Bible Voice Broadcasting Network	12035as		
1500	1530		Australia, HCJB Global Australia	15340as		
1500	1530	Sun	China, Voice of the Strait	4940do	9505do	
1500	1530		Clandestine, Sudan Radio Service/ SRS	17745af		
1500	1530		Guam, KSDA/AWR	12025as		
1500	1530		UK, BBC World Service	9410af	11860af	
1500	1530		Vietnam, Voice of Vietnam	7280as	9840as	12020as
1500	1550		New Zealand, Radio NZ International	5950pa		
1500	1555	Sat/Sun	Swaziland, TWR Swaziland	6025af		
1500	1557		Canada, Radio Canada International	9635as	11975as	
1500	1557		Libya, LJBC Voice of Africa	17725af	21695af	
1500	1557		Netherlands, R Netherlands Worldwide	15595as		
1500	1557		North Korea, Voice of Korea	7570eu	9335na	11710na 12015eu
1500	1600		Anguilla, Worldwide Univ Network	11775am		
1500	1600		Australia, ABC NT Alice Springs	2310do		
1500	1600		Australia, ABC NT Katherine	2485do		
1500	1600		Australia, Radio Australia	5995pa	6080pa	7240pa 9475pa 9590pa 11825as
1500	1600		Bahrain, Radio Bahrain	6010me		
1500	1600	Sat/Sun	Canada, CBC NQ SW Service	9625na		
1500	1600		Canada, CFRX Toronto ON	6070na		
1500	1600		Canada, CFVP Calgary AB	6030na		
1500	1600		Canada, CKZN St Johns NF	6160na		
1500	1600		Canada, CKZU Vancouver BC	6160na		
1500	1600		China, China Radio International	5955as	6095me	7325as 7410as 9720me 9870as 9800as 11965eu 13640eu 13740na 17630as
1500	1600		Equatorial Guinea, Radio African Network/Radio East Africa	15190af		
1500	1600		Equatorial Guinea, Radio African Network/Radio East Africa	15190af		
1500	1600		Malaysia, RTM/Traxx FM	7295do		
1500	1600		Myanmar, Myanmar Radio	5985as		
1500	1600		Nigeria, Voice of Nigeria/External Service	15120af		
1500	1600		Russia, Voice of Russia	4975va	7260as	9660as
1500	1600	DRM	Russia, Voice of Russia	5905eu	9675eu	
1500	1600		Slovakia, NEXUS/IRRS SW	15710va		
1500	1600	vl	Uganda, Dunamis Shortwave	4750af		
1500	1600		Uganda, UBC Radio	4975do		
1500	1600		UK, BBC World Service	5845as	5875as	5975as 6190af 6195as 7395as 9485as 9740as 9860af
1500	1600		United States, Overcomer Ministries	9460eu	13810me	17485af
1500	1600		USA, American Forces Network	4319usb	5446usb	5765usb 7812usb 12133usb 12759usb 13362usb
1500	1600		USA, EWTN/WEWN Irondale, AL	15610me		
1500	1600		USA, FBN/WTJC Newport NC	9370na		
1500	1600		USA, KJES Vado NM	11715ca		
1500	1600		USA, Voice of America	4930af	6080af	7575va 9930va 11765va 12055va 12150va 15580af 17715af 17895af
1500	1600		USA, Voice of America/Special English	6140va	7520va	9760va 9945va
1500	1600		USA, WBCQ Monticello ME	9330am		
1500	1600	Sat	USA, WBCQ Monticello ME	15420am		
1500	1600	Sat	USA, WHRI Cypress Creek SC	21630af		
1500	1600	Sun	USA, WHRI Cypress Creek SC	9840na	15680na	

SHORTWAVE GUIDE

1500	1600		USA, WINB Red Lion PA	13570am		
1500	1600		USA, WJHR International Milton FL	15550na		
1500	1600		USA, WRNO New Orleans LA	7505am		
			15590al			
1500	1600		USA, WTWW Lebanon TN	9479na		
1500	1600		USA, WWCR Nashville TN	7490af	9980na	
			13845na	15825na		
1500	1600		USA, WWRB Manchester TN	9385na		
1500	1600		USA, WYFR/Family Radio Worldwide	6280va		
			9495af	11565am	11855am	12015af
			15210sa	15795am	17760am	21840af
1500	1600		Zambia, CVC/1 Africa	13590af		
1500	1600		Zambia, Radio Christian Voice	6065af		
1504	1600	DRM	Canada, Radio Canada International	9800na		
1504	1600		Canada, Radio Canada International	9610na		
1515	1545	Sat	UK, Bible Voice Broadcasting Network	13670as		
1530	1545		India, All India Radio	9910as	7255al	
			9820al			
1530	1550	smtwhf	Vatican City State, Vatican Radio	11850as		
			13765as			
1530	1550	Sat	Vatican City State, Vatican Radio	7585as		
1530	1555	Sun	China, Voice of the Strait	4940do		
1530	1558	Sat	Vatican City State, Vatican Radio	7585am		
			11850as	13765as		
1530	1600	mtwhfa	Albania, Radio Tirana	13640na		
1530	1600		China, Xizang PBS/Holy Tibet	4905do	4920do	
			6200do			
1530	1600		Germany, AWR Europe	11675as		
1530	1600		Iran, VOIRI/IRIB 9915as	11655as		
1530	1600		Mongolia, Voice of Mongolia	9665as	12085al	
1530	1600	Sat	UK, BBC World Service	9410af	11860af	
1530	1600	h	UK, Bible Voice Broadcasting Network	13670as		
1551	1600		New Zealand, Radio NZ International	7440pa		
1551	1600	DRM	New Zealand, Radio NZ International	5950pa		

1600 UTC - 11AM EST / 10AM CST / 8AM PST

1600	1605	Sun	Croatia, Croatian Radio	6165eu		
1600	1615	mtwhfa	Croatia, Croatian Radio	6165eu		
1600	1615		Pakistan, PBC/Radio Pakistan	7510va	11575va	
1600	1627		Iran, VOIRI/IRIB 9915as	11655as		
1600	1630		Guam, KSDA/AWR	9585as	11690as	
1600	1630		Myanmar, Myanmar Radio	9730do		
1600	1630		Vietnam, Voice of Vietnam	7220me	7280eu	
			9550me	9730eu		
1600	1650	DRM	New Zealand, Radio NZ International	5950pa		
1600	1650		New Zealand, Radio NZ International	7440pa		
1600	1657		North Korea, Voice of Korea	9990va	11545va	
1600	1658		Germany, Deutsche Welle	5965as	9560as	
1600	1700		Anguilla, Worldwide Univ Network	11775am		
1600	1700		Australia, ABC NT Alice Springs	2310do		
1600	1700		Australia, ABC NT Katherine	2485do		
1600	1700		Australia, Radio Australia	5995pa	6080pa	
			7240pa	9475pa	9590pa	9710pa
			11825as			
1600	1700		Bahrain, Radio Bahrain	6010me		
1600	1700	Sat	Canada, CBC NQ SW Service	9625na		
1600	1700		Canada, CFRX Toronto ON	6070na		
1600	1700		Canada, CFVP Calgary AB	6030na		
1600	1700		Canada, CKZN St Johns NF	6160na		
1600	1700		Canada, CKZU Vancouver BC	6160na		
1600	1700		Canada, Radio Canada International	9610na		
1600	1700		China, China Radio International	6060as		
			7235as	7420af	9570af	11900af
			11940eu	11965eu	13760eu	
1600	1700		Egypt, Radio Cairo	12170af		
1600	1700		Equatorial Guinea, Radio African Network/Radio			
			East Africa 15190af			
1600	1700		Equatorial Guinea, Radio African Network/Radio			
			East Africa 15190af			
1600	1700		Ethiopia, Radio Ethiopia/External Service			
			7165va	9560af		
1600	1700		France, Radio France Internationale	15605af		
1600	1700		Malaysia, RTM/Traxx FM	7295do		
1600	1700		Russia, Voice of Russia	4975me	6130as	
			7305as	9470va		
1600	1700	DRM	Russia, Voice of Russia	7340as		
1600	1700		Slovakia, NEXUS/IRRS SW	15710va		
1600	1700		South Korea, KBS World Radio	9640as		
			9515eu			
1600	1700		Taiwan, Radio Taiwan International	11550as		
			12055as			
1600	1700	vl	Uganda, Dunamis Shortwave	4750af		
1600	1700		Uganda, UBC Radio	4975do		
1600	1700		UK, BBC World Service	3255af	5975as	
			6190af	7355as	9740as	
1600	1700	Sat	UK, BBC World Service	9410af	11860af	
1600	1700		USA, American Forces Network	4319usb		
			5446usb	5765usb	7812usb	12133usb
			12759usb	13362usb		
1600	1700		USA, EWTN/WEWN Irondale, AL	15610me		
1600	1700		USA, FBN/WTJC Newport NC	9370na		
1600	1700		USA, Voice of America	4930af	6080af	
			15580af	17895af		
1600	1700		USA, Voice of America/Special English	9395va		
			13600va	15460va		
1600	1700		USA, WBCQ Monticello ME	9330am		
1600	1700	Sat	USA, WBCQ Monticello ME	15420am		
1600	1700	Sun	USA, WHRI Cypress Creek SC	9840na		
1600	1700		USA, WHRI Cypress Creek SC	21630af		
1600	1700		USA, WINB Red Lion PA	13570am		
1600	1700		USA, WJHR International Milton FL	15550na		
1600	1700		USA, WRNO New Orleans LA	7505am		
			15590al			
1600	1700		USA, WTWW Lebanon TN	9479na		
1600	1700		USA, WWCR Nashville TN	9980na	12160af	
			13845na	15825na		
1600	1700		USA, WWRB Manchester TN	9385na		
1600	1700		USA, WYFR/Family Radio Worldwide	6085ca		
			11565am	11740af	11830am	13695am
			17540af	17690af	17760am	18980va
1600	1700		Zambia, CVC/1 Africa	13590af		
1600	1700		Zambia, Radio Christian Voice	6065af		
1604	1700		Canada, Radio Canada International	9610na		
1604	1700	DRM	Canada, Radio Canada International	9800na		
1615	1700	Sun	UK, BBC World Service	9410af	11860af	
1630	1700		Guam, KSDA/AWR	9790as		
1630	1700	mtwhf	UK, BBC World Service	9410af		
1630	1700	Sun	UK, Bible Voice Broadcasting Network	9460me		
1630	1700	mtwhf	USA, Voice of America	9785af	11905af	
			13635af			
1640	1650	mtwhfa	Turkmenistan, Turkmen Radiosi	4930eu		
1645	1700	mf	UK, Bible Voice Broadcasting Network	9460me		
1645	1700	twhfa	UK, Bible Voice Broadcasting Network	9460me		
1651	1700		New Zealand, Radio NZ International	9765pa		
1651	1700	DRM	New Zealand, Radio NZ International	9890pa		

1700 UTC - 12PM EST / 11AM CST / 9AM PST

1700	1715	f	UK, Bible Voice Broadcasting Network	9460me		
1700	1720	t	UK, Bible Voice Broadcasting Network	9460me		
1700	1745	h	UK, Bible Voice Broadcasting Network	9460me		
1700	1746		UK, BBC World Service	9410af	11860af	
1700	1750		New Zealand, Radio NZ International	9765pa		
1700	1750	DRM	New Zealand, Radio NZ International	9890pa		
1700	1800		Anguilla, Worldwide Univ Network	11775am		
1700	1800		Australia, ABC NT Alice Springs	2310do		
1700	1800		Australia, ABC NT Katherine	2485do		
1700	1800		Australia, Radio Australia	5995pa	6080pa	
			9475pa	9580pa	9710pa	11880pa
1700	1800		Bahrain, Radio Bahrain	6010me		
1700	1800	Sat	Canada, CBC NQ SW Service	9625na		
1700	1800		Canada, CFRX Toronto ON	6070na		
1700	1800		Canada, CFVP Calgary AB	6030na		
1700	1800		Canada, CKZN St Johns NF	6160na		
1700	1800		Canada, CKZU Vancouver BC	6160na		
1700	1800		Canada, Radio Canada International	9610na		
1700	1800	DRM	Canada, Radio Canada International	9800na		
1700	1800		China, China Radio International	6090as		
			6140as	6145eu	6165me	7235as
			7265af	7410as	7420as	9570af
			9695eu	11900af	13760eu	
1700	1800		Egypt, Radio Cairo	12170af		
1700	1800		Equatorial Guinea, Radio African Network/Radio			
			Africa 7190af			
1700	1800		Malaysia, RTM/Traxx FM	7295do		
1700	1800		Nigeria, Voice of Nigeria/External Service			
			15120af			
1700	1800		Russia, Voice of Russia	4975va	7240as	
			7330as	9470va	9880as	
1700	1800		South Africa, Channel Africa	15235af		
1700	1800		Swaziland, TWR Swaziland	3200af		
1700	1800		Taiwan, Radio Taiwan International	11850af		
1700	1800		Tajikistan, Voice of Tajik/External Service	7245va		
1700	1800	vl	Uganda, Dunamis Shortwave	4750af		
1700	1800		Uganda, UBC Radio	4975do		

1700	1800		UK, BBC World Service	3255af	5975as	
			6190af	9740as		
1700	1800	Sun	UK, Bible Voice Broadcasting Network	9460me		
1700	1800	Sat	UK, Bible Voice Broadcasting Network	9460me		
1700	1800		USA, American Forces Network	4319usb		
			5446usb	5765usb	7812usb	12133usb
			12759usb	13362usb		
1700	1800		USA, EWTN/WEWN Irondale, AL	15610me		
1700	1800		USA, FBN/WTJC Newport NC	9370na		
1700	1800		USA, Voice of America	6080af	13635af	
			15580af	17895af		
1700	1800		USA, WBCQ Monticello ME	9330am		
1700	1800	Sat	USA, WBCQ Monticello ME	15420am		
1700	1800	Sun	USA, WHRI Cypress Creek SC	9840na		
1700	1800		USA, WHRI Cypress Creek SC	21630af		
1700	1800		USA, WINB Red Lion PA	13570am		
1700	1800		USA, WJHR International Milton FL	15550na		
1700	1800		USA, WRNO New Orleans LA	7505am		
			15590al			
1700	1800		USA, WTWW Lebanon TN	9479na		
1700	1800		USA, WWCR Nashville TN	9980na	12160af	
			13845na	15825na		
1700	1800		USA, WWRB Manchester TN	9385na		
1700	1800		USA, WYFR/Family Radio Worldwide	7230af		
			7385af	13695am	15795am	17555am
			18980va	21680af		
1700	1800		Zambia, CVC/1 Africa	4965af	13590as	
1700	1800		Zambia, Radio Christian Voice	4965af		
1715	1730		Vatican City State, Vatican Radio	4005eu		
			5885eu	7250eu	7290eu	9645eu
1720	1740	fas	USA, Voice of America	4930af	12080af	
			15775af			
1730	1800		Clandestine, Sudan Radio Service/ SRS	9590af		
1730	1800	mtwhf	USA, Voice of America	4930af	12080af	
			15775af			
1730	1800		Vatican City State, Vatican Radio	9755af		
			11625af	13765af		
1745	1800		Bangladesh, Bangladesh Betar	7250as		
1745	1800	DRM	India, All India Radio	9950eu		
1745	1800		India, All India Radio	6280eu	7400af	
			7410af	7550eu	9415af	9445af
			11935af	6120al		
1751	1800		New Zealand, Radio NZ International	11725pa		
1751	1800	DRM	New Zealand, Radio NZ International	11675pa		

1800 UTC - 1PM EST / 12PM CST / 10AM PST

1800	1804		Canada, Radio Canada International	9610na		
1800	1804	DRM	Canada, Radio Canada International	9800na		
1800	1815		UK, Bible Voice Broadcasting Network	9460me		
1800	1830	w	Austria, AWR Europe	9515af		
1800	1830	DRM	Romania, Radio Romania International	5895eu		
1800	1830		South Africa, AWR Africa	3215af	3345af	
1800	1830		UK, BBC World Service	7260as	7355as	
1800	1830	Sat	UK, Bible Voice Broadcasting Network	9460me		
1800	1830		USA, Voice of America	6030af	13635af	
			15580af			
1800	1830	f	USA, Voice of America	4930af	12080af	
			15775af			
1800	1830	Sat/Sun	USA, Voice of America	4930af		
1800	1850		New Zealand, Radio NZ International	11725pa		
1800	1850	DRM	New Zealand, Radio NZ International	11675pa		
1800	1857		Netherlands, R Netherlands Worldwide	6020af		
			11655af			
1800	1857		North Korea, Voice of Korea	7570eu	12015eu	
1800	1859		Canada, Radio Canada International	9740va		
			11845af	15365af	17790af	
1800	1859		Poland, Polskie Radio Warsaw	9650eu		
1800	1859	DRM	Poland, Polskie Radio Warsaw	5895eu		
1800	1900		Anguilla, Worldwide Univ Network	11775am		
1800	1900		Australia, ABC NT Alice Springs	2310do		
1800	1900		Australia, ABC NT Katherine	2485do		
1800	1900		Australia, Radio Australia	6080pa	7240pa	
			9475pa	9580pa	9710pa	11880pa
1800	1900		Bahrain, Radio Bahrain	6010me		
1800	1900		Bangladesh, Bangladesh Betar	7250eu		
1800	1900		Canada, CFRX Toronto ON	6070na		
1800	1900		Canada, CFVP Calgary AB	6030na		
1800	1900		Canada, CKZN St Johns NF	6160na		
1800	1900		Canada, CKZU Vancouver BC	6160na		
1800	1900		China, China Radio International	9600eu		
			13760eu			
1800	1900		Equatorial Guinea, Radio African Network/Radio			
			Africa 7190af			
1800	1900	DRM	India, All India Radio	9950eu		
1800	1900		India, All India Radio	6280eu	7400af	
			7410af	9415af	9445af	11935af
			6120al			
1800	1900		Kuwait, Radio Kuwait	15540va		
1800	1900		Liberia, Star Radio	3960do	4025al	
1800	1900		Malaysia, RTM/Traxx FM	7295do		
1800	1900		Nigeria, Voice of Nigeria/External Service			
			15120af			
1800	1900	DRM	Romania, Radio Romania International	6065eu		
			7415eu			
1800	1900		Russia, Voice of Russia	4975va	7240as	
			7305va	7330as	9880af	12060af
1800	1900		South Korea, KBS World Radio	7275eu		
1800	1900		Swaziland, TWR Swaziland	3200af		
1800	1900		Taiwan, Radio Taiwan International	3965eu		
1800	1900	vl	Uganda, Dunamis Shortwave	4750af		
1800	1900		Uganda, UBC Radio	4975do		
1800	1900		UK, BBC World Service	3255af	5875eu	
			5945as	5955as	6005af	6190af
			7225eu	9615af	11810af	
1800	1900	Sat	UK, Bible Voice Broadcasting Network	6110me		
1800	1900	Sun	UK, Bible Voice Broadcasting Network	6110me		
			9460me			
1800	1900		USA, American Forces Network	4319usb		
			5446usb	5765usb	7812usb	12133usb
			12759usb	13362usb		
1800	1900		USA, EWTN/WEWN Irondale, AL	15610me		
1800	1900		USA, FBN/WTJC Newport NC	9370na		
1800	1900		USA, WBCQ Monticello ME	9330am	15420am	
1800	1900	Sun	USA, WHRI Cypress Creek SC	21630af		
1800	1900	hfas	USA, WHRI Cypress Creek SC	9840na		
1800	1900		USA, WINB Red Lion PA	13570am		
1800	1900		USA, WJHR International Milton FL	15550na		
1800	1900		USA, WRNO New Orleans LA	7505am		
			15590al			
1800	1900		USA, WTWW Lebanon TN	9479na		
1800	1900		USA, WWCR Nashville TN	9980na	12160af	
			13845na	15825na		
1800	1900		USA, WWRB Manchester TN	9385na		
1800	1900		USA, WYFR/Family Radio Worldwide	6045af		
			6915va	7240af	7395af	9895af
			11665af	13695af	15115af	1755am
			17535am			
1800	1900		Yemen, Republic of Yemen Radio/Radio Sana'a			
			6005me	9780me		
1800	1900		Zambia, CVC/1 Africa	4965af	13590as	
1800	1900		Zambia, Radio Christian Voice	4965af		
1805	1810	Sat	Croatia, Croatian Radio	6165eu		
1805	1815	mtwhf	Croatia, Croatian Radio	6165eu		
1830	1845		Rwanda, Radio Rwanda	6055do		
1830	1900		Bulgaria, Radio Bulgaria	6200eu	7400eu	
1830	1900	DRM	Bulgaria, Radio Bulgaria	9700eu		
1830	1900	mtwhf	Moldova, (Transnistria) Radio PMR	6240na		
1830	1900		South Africa, AWR Africa	11830af		
1830	1900		UK, BBC World Service	9410af		
1830	1900		USA, Voice of America	4930af	6080af	
			13635af	15580af		
1851	1900		New Zealand, Radio NZ International	11725pa		
1851	1900	DRM	New Zealand, Radio NZ International	15720pa		

1900 UTC - 2PM EST / 1PM CST / 11AM PST

1900	1902	vl	Uganda, Dunamis Shortwave	4750af		
1900	1915	Sun	UK, Bible Voice Broadcasting Network	9460me		
1900	1928		Germany, Deutsche Welle	15275af		
1900	1930		Germany, Deutsche Welle	9735af	13780af	
1900	1930		Vietnam, Voice of Vietnam	7280eu	9730eu	
1900	1945	DRM	India, All India Radio	9950eu		
1900	1945		India, All India Radio	6280eu	7400af	
			7410af	9415af	9445af	11935af
			6120al			
1900	1945	Sun	UK, Bible Voice Broadcasting Network	9470me		
1900	1950	DRM	New Zealand, Radio NZ International	15720pa		
1900	1950		New Zealand, Radio NZ International	11725pa		
1900	1957		Netherlands, R Netherlands Worldwide	7425af		
			9895af	11615af	11655af	
1900	1957		North Korea, Voice of Korea	7210af	9975af	
			11535va	11910af		
1900	2000		Anguilla, Worldwide Univ Network	11775am		
1900	2000		Australia, ABC NT Alice Springs	2310do		

1900	2000		Australia, ABC NT Katherine	2485do		
1900	2000		Australia, Radio Australia	6080pa	7240pa	
			9475pa	9500as	9580pa	9710pa
			11880pa			
1900	2000		Bahrain, Radio Bahrain	6010me		
1900	2000		Canada, CFRX Toronto ON	6070na		
1900	2000		Canada, CFVP Calgary AB	6030na		
1900	2000		Canada, CKZN St Johns NF	6160na		
1900	2000		Canada, CKZU Vancouver BC		6160na	
1900	2000		China, China Radio International		7295af	
			9435af			
1900	2000		Egypt, Radio Cairo	11510af		
1900	2000		Equatorial Guinea, Radio African Network/Radio Africa 7190af			
1900	2000		Kuwait, Radio Kuwait	15540va		
1900	2000		Liberia, Star Radio	3960do	4025al	
1900	2000		Malaysia, RTM/Traxx FM	7295do		
1900	2000		Nigeria, Voice of Nigeria/External Service			
			9690af	7255al		
1900	2000		Russia, Voice of Russia	4975va	7330eu	
			12060af			
1900	2000	smtwhf	Slovakia, NEXUS/IRRS SW	6090va		
1900	2000	mtwhf	Spain, Radio Exterior de Espana		9605af	
			9665eu			
1900	2000		Swaziland, TWR Swaziland	3200af		
1900	2000		Thailand, Radio Thailand World Service	7570eu		
1900	2000		Uganda, UBC Radio	4975do		
1900	2000		UK, BBC World Service	3255af	5875eu	
			5945as	5955as	6005af	6190af
			7225eu	9410af	9615af	11810af
1900	2000	Sat	UK, Bible Voice Broadcasting Network	9470me		
1900	2000	Sun	UK, Bible Voice Broadcasting Network	6030eu		
1900	2000		USA, American Forces Network		4319usb	
			5446usb	5765usb	7812usb	12133usb
			12759usb	13362usb		
1900	2000		USA, EWTN/WEWN Irondale, AL		15610af	
1900	2000		USA, FBN/WTJC Newport NC		9370na	
1900	2000		USA, KJES Vado NM	15385ca		
1900	2000		USA, Voice of America	4930af	4940af	
			6080af	15580af		
1900	2000		USA, Voice of America/Special English		9585va	
			12020va			
1900	2000		USA, WBCQ Monticello ME	9330am	15420am	
1900	2000	mtwhfa	USA, WBCQ Monticello ME	7415am		
1900	2000	asw	USA, WHRI Cypress Creek SC		17520af	
1900	2000	mtwhfa	USA, WHRI Cypress Creek SC		9840na	
1900	2000		USA, WINB Red Lion PA	13570am		
1900	2000		USA, WJHR International Milton FL		15550na	
1900	2000		USA, WRNO New Orleans LA		7505am	
			15590al			
1900	2000		USA, WTWW Lebanon TN	9479na		
1900	2000		USA, WWCR Nashville TN	9980na	12160af	
			13845na	15825na		
1900	2000		USA, WWRB Manchester TN	9385na		
1900	2000		USA, WYFR/Family Radio Worldwide		3230af	
			6020af	6085ca	6915va	7395af
			9480af	9705af	9885af	15115af
			15565va			
1900	2000		Zambia, CVC/1 Africa	4965af	13590as	
1900	2000		Zambia, Radio Christian Voice		4965af	
1905	1920	Sat	Mali, ORTM Du Mali	5995do		
1915	1945	Sat	UK, Bible Voice Broadcasting Network	6030eu		
1930	2000		Iran, VOIRI/IRIB	6010eu	6115eu	7320eu
			11695af	11860af		
1930	2000		Serbia, International Radio of Serbia		6100eu	
1930	2000		South Africa, RTE Radio Worldwide		6225af	
1930	2000		Turkey, Voice of Turkey	6050eu		
1945	2000	mtwhfa	Albania, Radio Tirana	7465eu	11635na	
1951	2000		New Zealand, Radio NZ International		11725pa	
1951	2000	DRM	New Zealand, Radio NZ International		17675pa	

2000 UTC - 3PM EST / 2PM CST / 12PM PST

2000	2025		Turkey, Voice of Turkey	6050eu		
2000	2027		Iran, VOIRI/IRIB	6010eu	6115eu	7320eu
			11695af	11860af		
2000	2030		Egypt, Radio Cairo	11510af		
2000	2030		South Africa, RTE Radio Worldwide		6225af	
2000	2030	Sat	Swaziland, TWR Swaziland	3200af		
2000	2030		USA, Voice of America	4930af	4940af	
			6080af	15580af		
2000	2030		Vatican City State, Vatican Radio		7365af	
			9755af	11625af		
2000	2050		New Zealand, Radio NZ International		11725pa	
2000	2050	DRM	New Zealand, Radio NZ International		17675pa	
2000	2057		Germany, Deutsche Welle	9735af	13780af	
			15275af			
2000	2057		Netherlands, R Netherlands Worldwide		5935af	
			7425af	11655af		
2000	2059		Germany, Deutsche Welle	9690af		
2000	2100		Anguilla, Worldwide Univ Network		11775am	
2000	2100		Australia, ABC NT Alice Springs		2310do	
2000	2100		Australia, ABC NT Katherine	2485do		
2000	2100		Australia, ABC NT Tennant Creek		2325do	
2000	2100		Australia, Radio Australia	9500as	9700as	
			11650as			
2000	2100	Sat/Sun	Australia, Radio Australia	6080va	7240pa	
			12080pa			
2000	2100		Bahrain, Radio Bahrain	6010me		
2000	2100	DRM	Belgium, TDP Radio/Disco Palace		17755am	
2000	2100		Canada, CFRX Toronto ON	6070na		
2000	2100		Canada, CFVP Calgary AB	6030na		
2000	2100		Canada, CKZN St Johns NF	6160na		
2000	2100		Canada, CKZU Vancouver BC		6160na	
2000	2100		China, China Radio International		5960eu	
			5985af	7285eu	7295af	7415eu
			9440af	9600eu		
2000	2100		Cuba, Radio Havana Cuba	11760am		
2000	2100		Equatorial Guinea, Radio African Network/Radio Africa 7190af			
2000	2100		Indonesia, Voice of Indonesia	9525va	11785al	
2000	2100		Kuwait, Radio Kuwait	15540va		
2000	2100		Liberia, Star Radio	3960do	4025al	
2000	2100		Malaysia, RTM/Traxx FM	7295do		
2000	2100		Nigeria, Voice of Nigeria/External Service			
			15120af			
2000	2100		Russia, Voice of Russia	7330eu		
2000	2100		Syria, Radio Damascus	9330eu	12085va	
2000	2100		Uganda, UBC Radio	4975do		
2000	2100		Uganda, UBC Radio	4975do		
2000	2100		UK, BBC World Service	3255af	6005af	
			6190af	9410af	9615af	11810af
2000	2100		Ukraine, Radio Ukraine International		6030na	
2000	2100		USA, American Forces Network		4319usb	
			5446usb	5765usb	7812usb	12133usb
			12759usb	13362usb		
2000	2100		USA, EWTN/WEWN Irondale, AL		15610af	
2000	2100		USA, FBN/WTJC Newport NC		9370na	
2000	2100	mtwhf	USA, Voice of America	7470va	9490va	
2000	2100		USA, WBCQ Monticello ME	7415am	15420am	
2000	2100		USA, WBCQ Monticello ME	5110am		
2000	2100	Sun	USA, WHRI Cypress Creek SC		7570na	
2000	2100	Sat	USA, WHRI Cypress Creek SC		15665af	
2000	2100		USA, WINB Red Lion PA	13570am		
2000	2100		USA, WJHR International Milton FL		15550na	
2000	2100		USA, WRNO New Orleans LA		7505am	
			15590al			
2000	2100		USA, WTWW Lebanon TN	9479na		
2000	2100		USA, WWCR Nashville TN	9980na	12160af	
			13845na	15825na		
2000	2100		USA, WWRB Manchester TN	9385na		
2000	2100		USA, WYFR/Family Radio Worldwide		5745va	
			6915va	9480af	11615af	15115af
			15195af	15520af	17535am	17555am
			17575sa			
2000	2100		Zambia, CVC/1 Africa	4965af	9505af	
2000	2100		Zambia, Radio Christian Voice		4965af	
2005	2100	m	South Africa, SA Radio League		3215af	
2030	2045		Thailand, Radio Thailand World Service	9535eu		
2030	2100		Laos, Lao National Radio	7145as		
2030	2100	mtwhf	Moldova, (Transnistria) Radio PMR		6240eu	
2030	2100		USA, Voice of America	4930af	6080af	
			7560as	15580af		
2030	2100	Sat/Sun	USA, Voice of America	4940af		
2030	2100		Vietnam, Voice of Vietnam	7220me	7280eu	
			9550me	9730eu		
2045	2100		India, All India Radio	6280eu	7550eu	
			9445eu	11620pa	11715pa	9910al
			9940al			
2045	2100	DRM	India, All India Radio	9950eu		
2045	2100	DRM	Vatican City State, Vatican Radio		9800am	
2050	2100		Vatican City State, Vatican Radio		4005eu	
			5885eu	7250eu		
2051	2100		New Zealand, Radio NZ International		11725pa	
2051	2100	DRM	New Zealand, Radio NZ International		15720pa	

2100 UTC - 4PM EST / 3PM CST / 1PM PST

2100	2105	m	South Africa, SA Radio League	3215af
2100	2120		Vatican City State, Vatican Radio	4005eu
			5885eu 7250eu	
2100	2130	mtwhfa	Albania, Radio Tirana	7530eu 9895na
2100	2130		Australia, ABC NT Alice Springs	2310do
2100	2130		Australia, ABC NT Katherine	2485do
2100	2130		Australia, ABC NT Tennant Creek	2325do
2100	2130		Austria, AWR Europe	9830af
2100	2130	Sat	Canada, CBC NQ SW Service	9625na
2100	2130	DRM	Vatican City State, Vatican Radio	9800am
2100	2150		New Zealand, Radio NZ International	11725pa
2100	2150	DRM	New Zealand, Radio NZ International	15720pa
2100	2157		Germany, Deutsche Welle	12070af 13780af
2100	2157		North Korea, Voice of Korea	7570eu 12015eu
2100	2159		Germany, Deutsche Welle	7280af 9545af
2100	2200		Anguilla, Worldwide Univ Network	11775am
2100	2200		Australia, Radio Australia	9500as 9660pa
			11650as 11695va 12080pa 13630pa	
			15515va	
2100	2200		Bahrain, Radio Bahrain	6010me
2100	2200		Belarus, Radio Belarus	6155eu 7360eu
			7390eu	
2100	2200	DRM	Belgium, TDP Radio	15755eu
2100	2200		Canada, CFRX Toronto ON	6070na
2100	2200		Canada, CFVP Calgary AB	6030na
2100	2200		Canada, CKZN St Johns NF	6160na
2100	2200		Canada, CKZU Vancouver BC	6160na
2100	2200		China, China Radio International	5960eu
			7205af 7285eu 7325af 7415eu	
			9600eu	
2100	2200		Equatorial Guinea, Radio African Network/Radio	
			Africa 7190af	
2100	2200		India, All India Radio	6280eu 7550eu
			9445eu 11620pa 11715pa 9910al	
			9940al	
2100	2200	DRM	India, All India Radio	9950eu
2100	2200		Malaysia, RTM/Traxx FM	7295do
2100	2200		Russia, Voice of Russia	7290eu 7330eu
2100	2200		Syria, Radio Damascus	9330va 12085va
2100	2200		Uganda, UBC Radio	4975do
2100	2200		UK, BBC World Service	3255af 3915as
			5875as 5910af 5965as 6190af	
			6195as 7465af 9915af	
2100	2200		USA, American Forces Network	4319usb
			5446usb 5765usb 7812usb 12133usb	
			12759usb 13362usb	
2100	2200		USA, EWTN/WEWN Irondale, AL	15610af
2100	2200		USA, FBN/WTJC Newport NC	9370na
2100	2200		USA, Voice of America	6080af 15580af
2100	2200		USA, WBCQ Monticello ME	7415am 9330am
			15420am	
2100	2200	Sat	USA, WBCQ Monticello ME	5110am
2100	2200	Sun	USA, WHRI Cypress Creek SC	7555na
2100	2200		USA, WINB Red Lion PA	13570am
2100	2200		USA, WJHR International Milton FL	15550na
2100	2200		USA, WRNO New Orleans LA	7505am
			15590al	
2100	2200		USA, WTWW Lebanon TN	9479na
2100	2200		USA, WWCR Nashville TN	7465na 9350na
			9980na 13845na	
2100	2200		USA, WWRB Manchester TN	9385na
2100	2200		USA, WYFR/Family Radio Worldwide	5950am
			6915va 7510va 15195af 17535am	
			17555am	
2100	2200		Zambia, CVC/1 Africa	4965af 9505af
2100	2200		Zambia, Radio Christian Voice	4965af
2115	2145		Egypt, Radio Cairo	6270eu
2130	2200		Australia, ABC NT Alice Springs	4835do
2130	2200		Australia, ABC NT Katherine	5025do
2130	2200	mtwhfa	Canada, CBC NQ SW Service	9625na
2130	2200		China, China Radio International	7365eu
2130	2200		Romania, Radio Romania International	6030na
			6115na 7310eu 7380eu	
2130	2200	DRM	Romania, Radio Romania International	6030eu
2130	2200		Turkey, Voice of Turkey	9610va
2151	2200		New Zealand, Radio NZ International	15720pa
2151	2200	DRM	New Zealand, Radio NZ International	17675pa

2200 UTC - 5PM EST / 4PM CST / 2PM PST

2200	2210		Uganda, UBC Radio	4975do
2200	2225		Turkey, Voice of Turkey	9610va
2200	2230		India, All India Radio	6280eu 7550eu
			9445eu 11620pa 11715pa 9910al	
			9940al	
2200	2230	DRM	India, All India Radio	9950eu
2200	2230		Serbia, International Radio of Serbia	6100eu
2200	2230		South Korea, KBS World Radio	3955eu
2200	2245		Egypt, Radio Cairo	6270eu
2200	2259	DRM	Canada, Radio Canada International	9800na
2200	2300		Anguilla, Worldwide Univ Network	6090am
2200	2300		Australia, ABC NT Alice Springs	4835do
2200	2300		Australia, ABC NT Katherine	5025do
2200	2300		Australia, Radio Australia	11695pa 12080pa
			13590va 13630pa 15230as 15240pa	
			15360pa 15415as 15515va 15560pa	
2200	2300		Bahrain, Radio Bahrain	6010me
2200	2300		Belarus, Radio Belarus	6155eu 7360eu
			7390eu	
2200	2300		Bulgaria, Radio Bulgaria	6200eu 7400eu
2200	2300	smtwhf	Canada, CBC NQ SW Service	9625na
2200	2300		Canada, CFRX Toronto ON	6070na
2200	2300		Canada, CFVP Calgary AB	6030na
2200	2300		Canada, CKZN St Johns NF	6160na
2200	2300		Canada, CKZU Vancouver BC	6160na
2200	2300		China, China Radio International	9590as
2200	2300		Equatorial Guinea, Radio African Network/Radio	
			Africa 7190af	
2200	2300		Malaysia, RTM/Traxx FM	7295do
2200	2300		New Zealand, Radio NZ International	15720pa
2200	2300	DRM	New Zealand, Radio NZ International	17675pa
2200	2300		Russia, Voice of Russia	7300eu
2200	2300	Sat/Sun	Spain, Radio Exterior de Espana	6125eu
2200	2300		Syria, Radio Damascus	9330va 12085va
2200	2300		UK, BBC World Service	3915as 5875as
			5910af 5965as 6135as 6195as	
			9740as 9915af	
2200	2300		USA, American Forces Network	4319usb
			5446usb 5765usb 7812usb 12133usb	
			12759usb 13362usb	
2200	2300		USA, EWTN/WEWN Irondale, AL	15610af
2200	2300		USA, FBN/WTJC Newport NC	9370na
2200	2300	smtwh	USA, Voice of America	5835va 7365va
			7425va 7570va 11860va	
2200	2300		USA, WBCQ Monticello ME	9330am
2200	2300	fasmt	USA, WBCQ Monticello ME	7415am
2200	2300	Sat	USA, WBCQ Monticello ME	5110am
2200	2300	Sun	USA, WHRI Cypress Creek SC	9615af
2200	2300		USA, WINB Red Lion PA	9265am
2200	2300		USA, WJHR International Milton FL	15550na
2200	2300		USA, WTWW Lebanon TN	9479na
2200	2300		USA, WWCR Nashville TN	7465na 9350na
			9980na 13845na	
2200	2300		USA, WWRB Manchester TN	3215na
2200	2300		USA, WYFR/Family Radio Worldwide	5950am
			15440am 11740am 17690af	
2200	2300		Zambia, Radio Christian Voice	4965af
2215	2230		Croatia, Croatian Radio	3985eu 7375ca
2230	2300		China, Xizang PBS/Holy Tibet	4905do 4920do
			6200do	
2230	2300		Guam, KSDA/AWR	15320as
2230	2300	mtwhf	Moldova, (Transnistria) Radio PMR	6240eu
2230	2300		USA, Voice of America/Special English	5850va
			7230va 9570va	
2245	2300		India, All India Radio	6055as 7305as
			11645as 13605as 9705al 9950al	

2300 UTC - 6PM EST / 5PM CST / 3PM PST

2300	0000		Anguilla, Worldwide Univ Network	6090am
2300	0000		Australia, ABC NT Alice Springs	4835do
2300	0000		Australia, ABC NT Katherine	5025do
2300	0000		Australia, Radio Australia	9660pa 12080pa
			13590va 13690pa 15230as 15360pa	
			15145as 15560pa 17795pa	
2300	0000		Bahrain, Radio Bahrain	6010me
2300	0000	smtwhf	Canada, CBC NQ SW Service	9625na
2300	0000		Canada, CFRX Toronto ON	6070na
2300	0000		Canada, CFVP Calgary AB	6030na
2300	0000		Canada, CKZN St Johns NF	6160na
2300	0000		Canada, CKZU Vancouver BC	6160na

2300	0000		China, China Radio International			5915as
			5990ca	6145na	7350eu	7410as
			9610as	11690pa	11790as	11840na
2300	0000		Cuba, Radio Havana Cuba			5040am
2300	0000		Egypt, Radio Cairo			11590na
2300	0000	vl	Guyana, Voice of Guyana			3290va
2300	0000		India, All India Radio			6055as 7305as
			11645as	13605as	9705al	
2300	0000		Malaysia, RTM/Traxx FM			7295do
2300	0000		New Zealand, Radio NZ International			15720pa
2300	0000	DRM	New Zealand, Radio NZ International			17675pa
2300	0000		Romania, Radio Romania International			5915va
			6015eu	7220as	7300as	
2300	0000		Russia, Voice of Russia			7250na
2300	0000		UK, BBC World Service			3915as 5875as
			6135as	6195as	7385as	9740as
2300	0000		Ukraine, Radio Ukraine International			7440na
2300	0000		USA, American Forces Network			4319usb
			5446usb	5765usb	7812usb	12133usb
			12759usb	13362usb		
2300	0000		USA, EWTN/WEWN Irondale, AL			15610af
2300	0000		USA, FBN/WTJC Newport NC			9370na
2300	0000		USA, Voice of America		5830va	7365va
			7480va	7570va	11860va	

2300	0000		USA, WBCQ Monticello ME		9330am	
2300	0000	fasmt	USA, WBCQ Monticello ME		7415am	
2300	0000	Sat	USA, WBCQ Monticello ME		5110am	
2300	0000	mtwhf	USA, WHRI Cypress Creek SC			5920am
2300	0000	Sat	USA, WHRI Cypress Creek SC			7335na
2300	0000		USA, WINB Red Lion PA		9265am	
2300	0000		USA, WTWW Lebanon TN		9479va	
2300	0000		USA, WWCR Nashville TN		5070na	7465na
			9980na	13845na		
2300	0000		USA, WWRB Manchester TN		3215na	6890va
2300	0000		USA, WYFR/Family Radio Worldwide			9430ca
			15400ca			
2300	0000		Zambia, Radio Christian Voice			4965af
2300	2330		Australia, Radio Australia		11695pa	15240pa
2300	2330		USA, Voice of America/Special English			6180va
			7460va	11655va	11840va	
2300	2330	DRM	Vatican City State, Vatican Radio			7370am
2300	2345		USA, WYFR/Family Radio Worldwide			11740na
2300	2355		Turkey, Voice of Turkey		5960va	
2330	0000		Australia, Radio Australia		17750as	
2330	0000		UK, BBC World Service		6170as	
2330	0000		USA, Voice of America/Special English			6180va
			7460va	11655va	11840va	13640va
2330	0000		Vietnam, Voice of Vietnam		9840as	12020as

MT SHORTWAVE STATION RESOURCE GUIDE

Albania, Radio Tirana .....**http://rtsh.sil.at/**
Anguilla, Worldwide Univ Network .....**www.worldwideuniversity**
.....**network.com/**
Australia, ABC NT Alice Springs.....**www.abc.net.au/radio/**
Australia, ABC NT Katherine.....**www.abc.net.au/radio/**
Australia, ABC NT Tennant Creek .....**www.abc.net.au/radio/**
Australia, HCJB Global Australia .....**www.hcjb.org/**
Australia, Radio Australia .....**www.abc.net.au/ra/**
Austria, AWR Europe **www.awr2.org/**
Bahrain, Radio Bahrain .....**www.radiobahrain.fm/**
Bangladesh, Bangladesh Betar .....**www.betar.org.bd/**
Belarus, Radio Belarus .....**www.radiobelarus.tvr.by/eng/**
Belgium, TDP Radio .....**www.airtime.be/schedule.html**
Belgium, TDP Radio/Disco Palace .....**www.airtime.be/schedule.html**
Bhutan, Bhutan Broadcasting Service .....**www.bbs.com.bt/**
Bulgaria, Radio Bulgaria .....**www.bnr.bg/**
Bulgaria, Radio Bulgaria/Euranet.....**www.bnr.bg/**
Canada, CBC NQ SW Service.....**www.cbc.ca/north/**
Canada, CFRX Toronto ON .....**www.cfrb.com**
Canada, CFVP Calgary AB.....**www.classiccountryam1060.com**
Canada, CKZN St Johns NF.....**www.cbc.ca/listen/index.html**
Canada, CKZU Vancouver BC.....**www.cbc.ca/bc**
Canada, Radio Canada International .....**www.rcinet.ca/**
China, China Radio International .....**www.cri.cn/**
China, Voice of the Strait.....**www.vos.com.cn**
China, Voice of the Strait.....**www.vos.com.cn**
Clandestine, Cotton Tree News.....**www.cottontreenews.org/**
Clandestine, Sudan Radio Service/ SRS ....**www.sudanradio.org/**
Croatia, Croatian Radio .....**www.hrt.hr/**
Cuba, Radio Havana Cuba .....**www.radiohc.cu/**
Egypt, Radio Cairo.....**www.ertu.org**
Equatorial Guinea, Radio African Network/Radio Africa
www.panambc.com
Equatorial Guinea, Radio African Network/Radio Africa # 2
www.panambc.com
Equatorial Guinea, Radio African Network/Radio East Africa
www.panambc.com
Ethiopia, Radio Ethiopia/External Service..**www.erta.gov.et**
France, Radio France Internationale.....**http://rfienglish.com**
Germany, AWR Europe.....**www.awr2.org/**
Germany, Deutsche Welle .....**www.dw-world.de/**
Germany, European Music Radio.....**www.emr.org.uk/**
Germany, Overcomer Ministries.....**www.overcomerministry.org/**
Germany, Pan American Broadcasting .....**www.radiopanam.com/**
Germany, Radio Gloria International .....**www.radiopanam.com/**
Germany, TWR Europe.....**www.twr.org**
Greece, Voice of Greece .....**www.voiceofgreece.gr/**
Guam, KSDA/AWR **www.awr2.org/**
Guam, KTWR/TWR.....**www.twr.org/**
Guyana, Voice of Guyana .....**www.voiceofguyana.com/**
India, All India Radio .....**www.allindiaradio.org/**
Indonesia, Voice of Indonesia .....**www.voi.co.id**
Iran, VOIRI/IRIB .....**www.irib.ir/English/**
Japan, NHK World/Radio Japan.....**www.nhk.or.jp/english/**
Kuwait, Radio Kuwait.....**www.media.gov.kw/**
Laos, Lao National Radio .....**www.lnr.org.la**
Liberia, Star Radio .....**www.starradio.org.lr/**
Malaysia, RTM/Traxx FM.....**www.traxxfm.net/index.php**
Malaysia, RTM/Voice of Malaysia.....**www.rtm.gov.my**
Mali, ORTM Du Mali .....**www.ortm.ml**
Monaco, TWR Europe .....**www.twr.org/**
Mongolia, Voice of Mongolia.....**www.mnb.mn**
Nepal, Radio Nepal .....**www.radionepal.org/**
Netherlands, R Netherlands Worldwide ....**www.radionetherlands.nl/**
New Zealand, Radio NZ International .....**www.rnzi.com**
Nigeria, Voice of Nigeria/External Service **www.voiceofnigeria.org**
Oman, Radio Sultanate of Oman .....**www.oman-tv.gov.om**
Pakistan, PBC/Radio Pakistan.....**www.radio.gov.pk**
Palau, T8WH/WHRI/Sound of Hope Radio**www.whr.org/**
Philippines, FEBC.....**www.febc.ph**
Philippines, PBS/ Radyo Pilipinas.....**www.pbs.gov.ph/**
Poland, Polskie Radio Warsaw .....**www.polskieradio.pl**
Romania, Radio Romania International ....**www.rri.ro/**
Russia, Voice of Russia .....**www.ruvr.ru/**
Rwanda, Radio Rwanda .....**www.orinfor.gov.rw/radio**
.....**rwanda.eng.html**
Saudi Arabia, BSKSA/Saudi Radio.....**www.saudiradio.net/**
Serbia, International Radio of Serbia.....**www.glassrbije.org**
Slovakia, NEXUS/IRRS SW .....**www.nexus.org**
South Africa, AWR Africa **www.awr2.org/**
South Africa, Channel Africa.....**www.channelafrica.org**
South Africa, RTE Radio Worldwide **www.rte.ie/radio1/**
South Africa, SA Radio League.....**www.sarl.org.za**
South Africa, TWR Africa.....**www.twr.org/**
South Korea, KBS World Radio .....**http://rki.kbs.co.kr/english/**
Spain, Radio Exterior de Espana .....**www.ree.rne.es/**
Sri Lanka, SLBC .....**www.slbc.lk**
Swaziland, TWR Swaziland .....**www.twrafrica.org**
Syria, Radio Damascus.....**www.rtv.gov.sy/**
Taiwan, Radio Taiwan International .....**http://english.rti.org.tw/**
Tajikistan, Voice of Tajik/External Service ..
Thailand, Radio Thailand World Service ...**www.hsk9.com/**
Turkey, Voice of Turkey.....**www.trt.net.tr**
Uganda, Dunamis Shortwave .....**www.biblevoice.org/stations/**
east-africa
Uganda, UBC Radio .....**www.ubconline.co.ug**
UK, BBC World Service.....**www.bbc.co.uk/worldservice/**
UK, Bible Voice Broadcasting Network .....**www.biblevoice.org/**
Ukraine, Radio Ukraine International .....**www.nrcu.gov.ua/**
United Arab Emirates, FEBA Radio .....**www.febaradio.info**
United States, Overcomer Ministries.....**www.overcomerministry.org/**
USA, American Forces Network .....**http://myafn.dodmedia.osd.mil/**
USA, EWTN/WEWN Irondale, AL .....**www.ewtn.com**
USA, FBN/WTJC Newport NC .....**www.fbnradio.com/**
USA, KNLS Anchor Point AK.....**www.knls.org/**
USA, Voice of America .....**www.voanews.com/**
USA, Voice of America/Special English.....**www.voanews.com/**
USA, WBCQ Monticello ME.....**www.wbcq.com/**
USA, WHRI Cypress Creek SC .....**www.whr.org/**
USA, WINB Red Lion PA .....**www.winb.com/**
USA, WRNO New Orleans LA .....**www.wrnoworldwide.org/**
USA, WTWW Lebanon TN .....**www.wtww.us**
USA, WWCR Nashville TN.....**www.wwcr.com**
USA, WWRB Manchester TN.....**www.wwrb.org/**
USA, WYFR/Family Radio Worldwide .....**www.familyradio.com/**
Vatican City State, Vatican Radio.....**www.vaticanradio.org**
Vietnam, Voice of Vietnam.....**www.vov.org.vn**
Yemen, Republic of Yemen Radio/Radio Sana'a...**www.yemenradio.net**
Zambia, CVC/1 Africa **www.1africa.tv**
Zambia, Radio Christian Voice.....**www.1africa.tv**

THE QSL REPORT

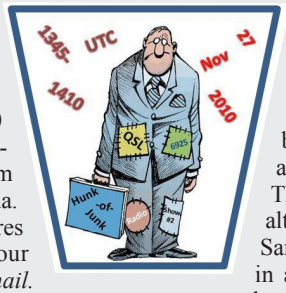
VERIFICATIONS RECEIVED BY OUR READERS

Gayle Van Horn, W4GVH
gaylevanhorn@monitoringtimes.com

QSL Mix-Alot

DXers Hearing 'Junk'

Actually, that's Hunk-a-Junk Radio that pirate DXers have been hearing on 6925 USB around 2200 and 0230 UTC. Programming has included classic radio jingles from Superman and Chiquita Banana. New contributor, Sea Lord, shares his QSL this month. Send your details to: *hunkajunkradio@gmail.com.*



(Artur Fernández Llorella, Catalonia, Spain/HCDX)

Euro Pirate Email Updates

Radio Amica - ***radioamica@gmail.com***
Radio Border Hunter - ***borderhunterradio@hotmail.com***
Radio Caroline - ***carolineradio@hotmail.com***
Radio Marconi - ***radiomarconi@msn.com***
Radio Merlin - ***radiomerlin@blueyonder.co.uk***
Radio Mustang - ***mustangradio@live.nl***
Skyline Radio International - ***skylinehorizon221@hotmail.com***

New Asian Clandestine

Radio Free Sarawak is broadcasting 1000-1100 on 15680 and 2230-2330 UTC on 7590 kHz. The station's goal is to provide an alternative viewpoint to Malaysia's Sarawak rural communities lacking in an independent media. Program details may be sent via the *Contact* link at **www.radiofreesarawak.org**

The Elusive Greenland

Danish Dxer Erik Køie recently verified Greenland's KNR Tasiilaq on 3815 USB. A full data card arrived in one week from TELE Greenland A/S, Teleservicecenter Aaiaat, Attention: Bo Mogensen, P.O. Box 217, DK-3950 Aaiaat. (*DX Window*) (or) Kissameqqortuunnguaq 15, P.O. Box 1007, DK-3900 Nuuk, Greenland.

Kuwait Just Barely

Listeners report Radio Kuwait is suffering consistently from poor audio quality. Give the English service a try on 15540 kHz, 1800-2100 UTC. Details to: P.O. Box 193, Safat, 13002 Kuwait. Website: **www.media.gov.kw/**

And Then She Started 'Tweeting'

In late 2010, I joined the *Twitter* phenomenon as a means to mirror my *Shortwave Central* blog. Daily 'tweets' include QSL tips, blog and *Monitoring Times* news, logs and brief shortwave information. You can now follow me @QSLRptMT as well as my blog at **http://mt-shortwave.blogspot.com** You can also email me at the above address. Comments, questions and submissions are always welcomed.

AUSTRALIA
HCJB Global Voice Australia, 11750 kHz. Full data station QSL. Received in three weeks for e-report to ***english@hcjb.org.au*** (Sam Wright, Biloxi, MS). Station address: P.O. Box 291, Kilsyth, VIC 3137 Australia. Website with streaming audio, Facebook and Twitter **www.hcjb.org.au**

BOLIVIA
Radio Santa Cruz, 6135 kHz. Full data QSL card, signed by Yolanda Marco Escobar, Secretaria. Received in 207 days for a Spanish report, one IRC and a self-addressed-envelope. Station address: Radio Santa Cruz, Instituto Radiofonico Fé y Alegria, Casilla 672 (3213), Santa Cruz de la Sierra, Bolivia (Fabricio Andrade Silva, Brazil/playdx2003).

CUBA
Radio Rebelde, 5025 kHz. E-QSL from Osana Osoria-Editora. Received in five days for a Spanish e-report to ***web@radiorebelde.icrt.cu*** (Fernández). Station website with streaming, on-demand and podcasting **www.radiorebelde.cu/**

GREECE
ERT 3 Thessaloniki, 9935 kHz. Full data word document as verification from Tatiana Tsioli ***ttsioli@ert3.gr*** Received in 132 days for an English airmail report and $5.00US. Veri signer attached an eight page ERT3-made tourist and history brochure. Station address: Aggelaki 14, 546 36 Thessaloniki, Greece (Al Muick, Kandahar Airfield, Afghanistan). Website with streaming audio **www.ert3.gr**

LAOS
Lao National Radio, 6130 kHz. No-data email ***thank-you,*** from Inpanh Satchapansy ***inpanhs@hotmail.com***. Director of the Foreign Language Department and Head of External Relations for Lao National Radio (Muick). Station address: P.O. Box 310, Phaynam Road, Vientiane, Laos. Website with on-demand audio **www.lnr.org.la** Email: ***laoradio@lnr.org.la***

MEDIUM WAVE
KCJJ 1630 AM kHz. No-data QSL card received via snail mail, signed by Tom Suter - General Manager, plus response after my email follow-up. Received in five days for an email to ***suterman7@aol.com*** (Mauricio Salamanca, Spain/DX News). Streaming audio and Twitter **www.1630kcjj.com/**. Station address: KCJJ Radio, P.O. Box 2118, Iowa City, IA 52244 USA (or) 845 Quarry Rd., Suite 120, Coralville, IA 52241 USA.

KIHU, 1010 AM kHz, Tooele, Utah. Prepared QSL card and partial data letter signed by Chris Bissonnette-Operations Manager. Received in 37 days for AM report. QSL address: 3256 Penryn Rd., #100, Loomis, CA 95650 USA (John Wilkins, CO/DX News).

KYDZ, 1140 AM kHz. Prepared QSL card and KYDZ stickers from Terry B. Teagarden. Received in 22 days for follow up report to Chief Engineer (Wilkins). Streaming audio at **www.kydzradio.com.** Station address: KYDZ Radio 1140AM, 6655 West Sahara Ave., Suite D-110, Las Vegas, NV 89146-0851 USA.

KYNO, 940 AM kHz. ***Truth on the Table Radio.*** Verification letter signed by Dave Hull. Received in 21 days for an AM report. Station address: 1415 Fulton Street, Fresno, CA 93721 USA (Patrick Martin, Seaside, OR). Streaming audio and Facebook **www.940kyno.com/**

WEZE, 590 AM kHz. ***The Word.*** Email verification from Frank Kelly-Engineering. Received in four days for follow-up report to ***frankk@salemradioboston.com*** (Salamanca). Station address: 500 Victory Rd, Second Floor, Quincy, MA 02171 USA. Streaming, on-demand, Facebook and Twitter at **www.wezeradio.com/**

WKBN, 570 AM kHz. ***Newstalk 570 - The Voice of the Valley.*** No-data ***Clear Channel Radio Youngstown*** card plus station sticker. Received in one week for AM report and a SASE. Station address: 7461 South Avenue, Youngstown, OH 44512 USA. Logged while in Pittsburg, PA (Eike Bierwirth, Germany/HCDX). Website with streaming audio **www.570wkbn.com/**

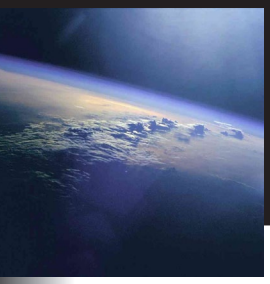
PAPUA NEW GUINEA
Radio Fly, 3915 kHz. E-QSL from Jobby Paiva with mention they are printing QSL cards. Received in five days for an English follow-up email to: ***jobby.paiva@gmail.com*** (Wilkins). Received e-QSL from Jobby for my Mp3 audio clip (Ed Kusalik, Alberta, Canada).

UNITED ARAB EMIRATES
Deutsche Welle relay via Dhabbaya, 12045 kHz. Full data DRM/Digital Radio Mondiale Antenna card, with site notation, signed by Horst Scholz-Transmission Management. Received in 78 days. Station address: D-53110 Bonn, Germany (Kusalik). Streaming, on-demand, podcasting, and video **www.dw-world.de**

UNITED STATES
WTWW, 9480 kHz Lebanon, Tennessee. Full data McClintock transmitter card, signed by Dan Dixon-Manager. Received in 260 days for an English report and $1.00US. Station address: 1784 West Northfield Blvd., # 305, Murfreesboro, TN 37129 USA. (Bill Wilkins, Springfield, MO) Received same in 220 days (Kusalik).

UTILITY
GFF Kinloss Rescue, 5680 kHz. Verification letter and information folder. Received in ten days for a utility report. QSL address: Aeronautical Rescue Coordination Centre, Royal Air Force Kinloss, Forres, Morayshire, IV36 3UH, United Kingdom (Francesco/playdx2003).

NRV US Coast Guard, 12585 kHz. Full data verification letter signed by OS2 Ryan S. Tolentino, Communication Unit Controller. Received in 63 days with no return postage. QSL address: USCG Sector Guam Command Center, PSC 455, Box 176, FPO AP 96540-1056 (Muick).



MTXtra
Shortwave Broadcast Guide

ARABIC / CHINESE

The following language schedule is extracted from our new *MTXtra Shortwave Broadcast Guide* pdf which is a free download to all *MTXpress* subscribers. This new online *Shortwave Broadcast Guide* has more than 9,100 station entries that include all languages being broadcasts via shortwave radio worldwide, sorted by time and updated monthly.

2000 UTC - 3PM EST / 2PM CST / 12PM PST

2000	2058		Algeria, Radio Algerienne	Arabic	7455af 9390af
2000	2100		Bahrain, Radio Bahrain	Arabic	9745me
2000	2059		Canada, Radio Canada International	Arabic	11865af 13650af
2000	2100		China, China Radio International	Arabic	6100va 6185va 7235va
2000	2100		Clandestine, Radio Nacional De La R.A.S.D.	Arabic	6297af
2000	2100		Djibouti, RDTV de Djibouti	Arabic	4780do
2000	2100		Egypt, Radio Cairo	Arabic	6860pa
2000	2100		Egypt, Radio Cairo/ General Program	Arabic	9305va
2000	2100		Egypt, Radio Cairo/ Voice of the Arabs	Arabic	9295af
2000	2100		Egypt, Radio Cairo/ Waadi El Nile	Arabic	9250af
2000	2015	Sun	Germany, Pan American Broadcasting	Arabic	6040me
2000	2030	Sat	Germany, Pan American Broadcasting	Arabic	6040af
2000	2100		Iran, VOIRI/IRIB	Arabic	6065me
2000	2015		Jordan, Radio Jordan	Arabic	9830eu
2000	2100		Kuwait, Radio Kuwait	Arabic	6080me
2000	2100		Libya, LJBC Voice of Africa	Arabic	9880af 11850af
2000	2100		Morocco, Radiodiffusion TV Marocaine	Arabic	15345va
2000	2100		Oman, Radio Sultanate of Oman	Arabic	15140va
2000	2100		Russia, Voice of Russia	Arabic	5975va 7345va
2000	2100		Saudi Arabia, BSKSA/General Program	Arabic	9555af 9870eu
2000	2100		Saudi Arabia, BSKSA/Qu'ran Program	Arabic	9580eu 11820eu 11915af 11930af
2000	2100		South Africa, AWR Africa	Arabic	11800va 15155me
2000	2100		South Korea, KBS World Radio	Arabic	9430af
2000	2100	Sat/Sun	Spain, Radio Exterior de Espana	Arabic	7265af
2000	2100		Sudan, Sudan RDTV Corp/Sudanese Radio	Arabic	7200do
2000	2100		Tunisia, RDTV Tunisienne	Arabic	7345af
2000	2100		UK, BBC World Service	Arabic	5790va 6110af 6195me 7375me 9915af
2000	2030		UK, FEBA Radio	Arabic	9550me
2000	2100		USA, WYFR/Family Radio Worldwide	Arabic	17690af
2000	2100		Yemen, Republic of Yemen Radio/Radio Sana'a	Arabic	6005me 9780me
2000	2015		Sweden, IBRA Radio	Arabic (Libyan)	11725af
2000	2100		Cyprus, (Northern) R Bayrak International	Arabic/English/Greek/Turkish	6150eu
2000	2100		Morocco, Radio Mediterranee Intl/Medi 1	Arabic/French	9575va
2000	2100		Chad, Rdiff. National Tchadienne/Radio Tchad	Arabic/French/vernaculars	4905do 6165al 7120al
2000	2100		Mauritania, Radio Mauritanie	Arabic/French/vernaculars	4845do 7245al
2004	2100		Canada, Radio Canada International	Arabic	9610na
2030	2100		Cuba, Radio Havana Cuba	Arabic	15370eu
2045	2100		UK, Bible Voice Broadcasting Network	Arabic	6145af

2100 UTC - 4PM EST / 3PM CST / 1PM PST

2100	2158		Algeria, Radio Algerienne	Arabic	7455af 9390af
2100	2200		Bahrain, Radio Bahrain	Arabic	9745me
2100	2104		Canada, Radio Canada International	Arabic	9610na
2100	2200		Clandestine, Radio Nacional De La R.A.S.D.	Arabic	6297af
2100	2103		Djibouti, RDTV de Djibouti	Arabic	4780do
2100	2200		Egypt, Radio Cairo	Arabic	6860pa
2100	2200		Egypt, Radio Cairo/ General Program	Arabic	9305va
2100	2200		Egypt, Radio Cairo/ Voice of the Arabs	Arabic	9295af
2100	2200		Egypt, Radio Cairo/ Waadi El Nile	Arabic	9250af
2100	2200		Iran, VOIRI/IRIB	Arabic	6065me
2100	2200		Kuwait, Radio Kuwait	Arabic	6080me
2100	2157		Libya, LJBC Voice of Africa	Arabic	9880af 11850af
2100	2200		Morocco, Radiodiffusion TV Marocaine	Arabic	15345va
2100	2200		Oman, Radio Sultanate of Oman	Arabic	15140va
2100	2200		Saudi Arabia, BSKSA/General Program	Arabic	9555af 9870eu
2100	2200		Saudi Arabia, BSKSA/Qu'ran Program	Arabic	9580eu 11820eu 11915eu 11930af
2100	2200	Sat/Sun	Spain, Radio Exterior de Espana	Arabic	7265af
2100	2110		Tunisia, RDTV Tunisienne	Arabic	9725me 12005me
2100	2200		Tunisia, RDTV Tunisienne	Arabic	7225eu 7345af
2100	2115		UK, Bible Voice Broadcasting Network	Arabic	6145af
2100	2145	w	UK, Bible Voice Broadcasting Network	Arabic	6145af
2100	2145		USA, WYFR/Family Radio Worldwide	Arabic	11665eu
2100	2200		Yemen, Republic of Yemen Radio/Radio Sana'a	Arabic	6005me 9780me
2100	2200		Cyprus, (Northern) R Bayrak International	Arabic/English/Greek/Turkish	6150eu
2100	2200		Morocco, Radio Mediterranee Intl/Medi 1	Arabic/French	9575va
2100	2200		Chad, Rdiff. National Tchadienne/Radio Tchad	Arabic/French/vernaculars	4905do 6165al 7120al
2100	2200		Mauritania, Radio Mauritanie	Arabic/French/vernaculars	4845do 7245al
2140	2200		Vatican City State, Vatican Radio	Arabic	4005eu 5885eu 7250me

2200 UTC - 5PM EST / 4PM CST / 2PM PST

2200	2300		Bahrain, Radio Bahrain	Arabic	9745me
2200	2300		Clandestine, Radio Nacional De La R.A.S.D.	Arabic	6297af
2200	2300		Egypt, Radio Cairo/ General Program	Arabic	9305va
2200	2300		Egypt, Radio Cairo/ Voice of the Arabs	Arabic	9295af
2200	2300		Egypt, Radio Cairo/ Waadi El Nile	Arabic	9250af
2200	2300		Iran, VOIRI/IRIB	Arabic	6065me
2200	2300		Saudi Arabia, BSKSA/General Program	Arabic	9555af 9870eu

2200	2300	Saudi Arabia, BSKSA/Qu'ran Program	Arabic
		9580eu 11820eu 11915eu	11930af
2200	2210	Tunisia, RDTV Tunisienne	Arabic 7225eu
2200	2300	Tunisia, RDTV Tunisienne	Arabic 7345af
2200	2245	USA, WYFR/Family Radio Worldwide	Arabic
		15115af	
2200	2215	Yemen, Republic of Yemen Radio/Radio Sana'a	
		Arabic 6005me 9780me	
2200	2300	Cyprus, (Northern) R Bayrak International	
		Arabic/English/Greek/Turkish	6150eu
2200	2300	Morocco, Radio Mediterranee Intl/Medi 1	
		Arabic/French 9575va	
2200	2230	Chad, Rdiff. National Tchadienne/Radio Tchad	
		Arabic/French/vernaculars 4905do	6165al
		7120al	
2200	2230 Sat	Chad, Rdiff. National Tchadienne/Radio Tchad	
		Arabic/French/vernaculars 4905do	6165al
		7120al	
2200	2300	Mauritania, Radio Mauritanie	Arabic/French/ver-
		naculars 4845do	7245al

2300 UTC - 6PM EST / 5PM CST / 3PM PST

2300	0000	Bahrain, Radio Bahrain	Arabic 9745me
2300	0000	Egypt, Radio Cairo/ General Program	Arabic
		9305va	
2300	0000	Iran, VOIRI/IRIB Arabic	6065me
2300	0000	Tunisia, RDTV Tunisienne	Arabic 7345af
2300	0000	Cyprus, (Northern) R Bayrak International	
		Arabic/English/Greek/Turkish	6150eu
2300	0000	Morocco, Radio Mediterranee Intl/Medi 1	
		Arabic/French 9575va	
2300	0000	Mauritania, Radio Mauritanie	Arabic/French/ver-
		naculars 4845do	7245al
2330	0000	Egypt, Radio Cairo	Arabic 9250ca
		9360sa	

MT CHINESE SHORTWAVE BROADCAST GUIDE

0000 UTC - 7PM EST / 6PM CST / 4PM PST

0000	0027	Iran, VOIRI/IRIB	5945as	7325as	9710as
0000	0030	China, Fujian PBS	3990do	5970do	
0000	0030	China, Yunnan PBS	6035as		
0000	0057	North Korea, Voice of Korea	13650as	15100as	
0000	0100 mtwhfas	China, China Huayi Broadcasting Corp	4830do		
		5050do			
0000	0100	China, Hulun Buir PBS	3900do	6080do	
0000	0100	China, Hunan PBS	4990do		
0000	0100	China, Nei Menggu PBS	6040do	7270do	
		7420do 9520do	9750do		
0000	0100	China, Qinghai PBS	4220do	4750do	
		5990do 6145do			
0000	0100	China, Qinghai PBS	4750do	6060do	
		7225do			
0000	0100	China, Voice of the Strait	9505do		
0000	0100	China, Voice of the Strait/Entertainment Ch			
		7280do			
0000	0100	China, Xinjiang PBS	5960do	7260do	
		7310do 11770do			
0000	0100	USA, Voice of America	7495as	9545as	
		11925as 15385as	17645as	21580as	

0100 UTC - 8PM EST/ 7PM CST / 5PM PST

0100	0130	China, Yunnan PBS	6035as
0100	0200 mtwhfas	China, China Huayi Broadcasting Corp	4830do
		5050do	
0100	0200	China, Hulun Buir PBS	3900do 6080do
0100	0200	China, Hunan PBS	4990do
0100	0200	China, Nei Menggu PBS	6040do 7270do
		7420do 9520do	9750do
0100	0200	China, Qinghai PBS	4220do 6145do
0100	0200	China, Sichuan PBS	4750do 6060do
		7225do	
0100	0200	China, Voice of the Strait	9505do
0100	0200	China, Voice of the Strait/Entertainment Ch	
		7280do	
0100	0200	China, Xinjiang PBS	5960do 7260do
		7310do 11770do	
0100	0200	China, Xizang PBS/Tibet	4820do 4905do
		5240do 5935do	6130do 6200do
		7240do 7255do	7385do
0100	0200	China, Xizang PBS/Tibet	4820do 4905do
		5240do 5935do	6130do 6200do
		7240do 7255do	7385do
0130	0200	USA, FBN/WTJC Newport NC	9370na

0200 UTC - 9PM EST / 8PM CST / 6PM PST

0200	0257	North Korea, Voice of Korea	7220as 9345as
		9730as	
0200	0300 mtwhfas	China, China Huayi Broadcasting Corp	4830do
		5050do	
0200	0300	China, Hulun Buir PBS	3900do 6080do
0200	0300	China, Hunan PBS	4990do
0200	0300	China, Nei Menggu PBS	6040do 7270do
		7420do 9520do	9750do
0200	0300	China, Sichuan PBS	4750do 6060do
		7225do	
0200	0300	China, Voice of the Strait	9505do
0200	0300	China, Voice of the Strait/Entertainment Ch	
		7280do	
0200	0300	China, Xinjiang PBS	5960do 7260do
		7310do 11770do	
0200	0300	China, Xizang PBS/Tibet	4820do 4905do
		5240do 5935do	6130do 6200do
		7240do 7255do	11860do 11950do
0230	0300	China, Qinghai PBS	4220do 5990do
		6145do 9780do	9850do

0300 UTC - 10PM EST / 9PM CST / 7PM PST

0300	0357	North Korea, Voice of Korea	13650as	15100as	
0300	0400 mtwhfas	China, China Huayi Broadcasting Corp	4830do		
		5050do			
0300	0400	China, Hulun Buir PBS	3900do	6080do	
0300	0400	China, Hunan PBS	4990do		
0300	0400	China, Nei Menggu PBS	6040do	7270do	
		7420do 9520do	9750do		
0300	0400	China, Qinghai PBS	4220do	5990do	
		6145do 9780do	9850do		
0300	0400	China, Sichuan PBS	4750do	6060do	
		7225do			
0300	0400	China, Voice of the Strait	9505do		
0300	0400	China, Voice of the Strait/Entertainment Ch			
		7280do			
0300	0400	China, Xinjiang PBS	5960do	7260do	
		9600do 11770do			
0300	0400	China, Xizang PBS/Tibet	4820do	4905do	
		5240do 5935do	6130do	6200do	
		7240do 7255do	11860do	11950do	
0300	0400	Saudi Arabia, BSKSA/Saudi Radio		21665as	

0400 UTC - 11PM EST / 10PM CST / 8PM PST

0400	0500 mtwhfas	China, China Huayi Broadcasting Corp	4830do
		5050do	
0400	0500	China, Hulun Buir PBS	3900do 6080do
0400	0500	China, Hunan PBS	4990do
0400	0500	China, Nei Menggu PBS	6040do 7270do
		7420do 9520do	9750do
0400	0500	China, Qinghai PBS	4220do 5990do
		6145do 9780do	9850do
0400	0500	China, Sichuan PBS	4750do 6060do
		7225do	
0400	0500	China, Voice of the Strait	9505do
0400	0500	China, Voice of the Strait/Entertainment Ch	
		7280do	
0400	0500	China, Xinjiang PBS	5960do 7260do
		9600do 11770do	
0400	0500	China, Xizang PBS/Tibet	4820do 4905do
		5240do 5935do	6130do 6200do
		7240do 7255do	11860do 11950do
0400	0500	Saudi Arabia, BSKSA/Saudi Radio	21665as

0500 UTC - 12AM EST / 11PM CST / 9PM PST

0500	0530	China, Qinghai PBS	4220do 5990do
0500	0530	Romania, Radio Romania International	15160as
0500	0530 DRM	Romania, Radio Romania International	17870as
0500	0600 mtwhfas	China, China Huayi Broadcasting Corp	4830do

		5050do			
0500	0600	China, Hulun Buir PBS	3900do	6080do	
0500	0600	China, Hunan PBS	4990do		
0500	0600	China, Nei Menggu PBS	6040do	7270do	
		7420do	9520do	9750do	
0500	0600	China, Qinghai PBS	4220do	5990do	
0500	0600	China, Sichuan PBS	4750do	6060do	
		7225do			
0500	0600	China, Voice of the Strait	9505do		
0500	0600	China, Voice of the Strait/Entertainment Ch			
		7280do			
0500	0600	China, Xinjiang PBS	5960do	7260do	
		9600do	11770do		
0500	0600	China, Xizang PBS/Tibet	4820do	4905do	
		5240do	5935do	6130do	6200do
		7240do	7255do	11860do	11950do
0500	0600	Saudi Arabia, BSKSA/Saudi Radio		21665as	

0600 UTC - 1AM EST / 12AM CST / 10PM PST

0600	0700 mtwhfas	China, China Huayi Broadcasting Corp		4830do	
		5050do			
0600	0700	China, Hulun Buir PBS	3900do	6080do	
0600	0700	China, Nei Menggu PBS	6040do	7270do	
		7420do	9520do	9750do	
0600	0700	China, Qinghai PBS	4220do	5990do	
0600	0700	China, Sichuan PBS	4750do	6060do	
		7225do			
0600	0700	China, Voice of the Strait	9505do		
0600	0700	China, Voice of the Strait/Entertainment Ch			
		7280do			
0600	0700	China, Xinjiang PBS	5960do	7260do	
		9600do	11770do		
0600	0700	China, Xizang PBS/Tibet	4820do	4905do	
		5240do	5935do	6130do	6200do
		7240do	7255do	11860do	11950do
0630	0700	China, Qinghai PBS	4220do	4750do	
		5990do	6145do	9780do	

0700 UTC - 2AM EST / 1AM CST / 11PM PST

0700	0800 mtwhfas	China, China Huayi Broadcasting Corp		4830do	
		5050do			
0700	0800	China, Nei Menggu PBS	6040do	7270do	
		7420do	9520do	9750do	
0700	0800	China, Qinghai PBS	4220do	4750do	
		5990do	6145do	9780do	
0700	0800	China, Sichuan PBS	4750do	6060do	
		7225do			
0700	0800	China, Voice of the Strait	9505do		
0700	0800	China, Voice of the Strait/Entertainment Ch			
		7280do			
0700	0800	China, Xinjiang PBS	5960do	7260do	
		9600do	11770do		
0700	0800	China, Xizang PBS/Tibet	4820do	4905do	
		5240do	5935do	6130do	6200do
		7240do	7255do	11860do	11950do

0800 UTC - 3AM EST / 2AM CST / 12AM PST

0800	0857	North Korea, Voice of Korea		7220as	9345as
0800	0900 mtwhfas	China, China Huayi Broadcasting Corp		4830do	
		5050do			
0800	0900	China, Hulun Buir PBS	3900do	6080do	
0800	0900	China, Nei Menggu PBS	6040do	7270do	
		7420do	9520do	9750do	
0800	0900	China, Qinghai PBS	4220do	4750do	
		5990do	6145do	9780do	
0800	0900	China, Sichuan PBS	4750do	6060do	
		7225do			
0800	0900	China, Voice of the Strait	9505do		
0800	0900	China, Voice of the Strait/Entertainment Ch			
		7280do			
0800	0900	China, Xinjiang PBS	5960do	7260do	
		9600do	11770do		
0800	0900	China, Xizang PBS/Tibet	4820do	4905do	
		5240do	5935do	6130do	6200do
		7240do	7255do	11860do	11950do
0800	0900	Saudi Arabia, BSKSA/Saudi Radio		15610as	
0830	0900	China, Fujian PBS	3990do	5970do	

0900 UTC - 4AM EST / 3AM CST / 1AM PST

0900	0930	Japan, NHK World/Radio Japan		6090as	
0900	1000 mtwhfas	China, China Huayi Broadcasting Corp		4830do	
		5050do			
0900	1000	China, Fujian PBS	3990do	5970do	
0900	1000	China, Hulun Buir PBS	3900do	6080do	
0900	1000	China, Hunan PBS	4990do		
0900	1000	China, Nei Menggu PBS	6040do	7270do	
		7430do	9520do	9750do	
0900	1000	China, Qinghai PBS	4220do	4750do	
		5990do	6145do		
0900	1000	China, Sichuan PBS	4750do	6060do	
		7225do			
0900	1000	China, Voice of the Strait	9505do		
0900	1000	China, Voice of the Strait/Entertainment Ch			
		7280do			
0900	1000	China, Xinjiang PBS	5960do	7260do	
		9600do	11770do		
0900	1000	China, Xizang PBS/Tibet	4820do	4905do	
		5240do	5935do	6130do	6200do
		7240do	7255do		
0900	1000 Sat/Sun	Clandestine, Sound of Hope Radio Network			
		9540as	11760as		
0900	1000	Saudi Arabia, BSKSA/Saudi Radio		15610as	
0900	1000	USA, Voice of America	9845as	9855as	
		11855as	11965as	13650as	13765as
		15670as			
0930	1000	France, Radio France Internationale		7325as	
		11875eu	12025as		
0945	1000	China, Fujian PBS	5005do	5040do	

1000 UTC - 5AM EST / 4AM CST / 2AM PST

1000	1030	China, Fujian PBS	5005do	5040do	
1000	1030	China, Yunnan PBS		6035as	
1000	1030	France, Radio France Internationale		7325as	
		11875eu	12025as		
1000	1100 mthfas	China, China Huayi Broadcasting Corp		4830do	
		5050do			
1000	1100	China, Fujian PBS	3990do	5970do	
1000	1100	China, Hulun Buir PBS	3900do	6080do	
1000	1100	China, Hunan PBS	4990do		
1000	1100	China, Nei Menggu PBS	6040do	7270do	
		7420do	9520do	9750do	
1000	1100	China, Qinghai PBS	4220do	4750do	
		5990do	6145do		
1000	1100	China, Sichuan PBS	4750do	6060do	
		7225do			
1000	1100	China, Voice of the Strait	9505do		
1000	1100	China, Voice of the Strait/Entertainment Ch			
		7280do			
1000	1100	China, Xinjiang PBS	5960do	7260do	
		9600do	11770do		
1000	1100	China, Xizang PBS/Tibet	4820do	4905do	
		5240do	5935do	6130do	6200do
		7240do	7255do	7385do	
1000	1100 Sat/Sun	Clandestine, Sound of Hope Radio Network			
		9540as	11760as		
1000	1100	Malaysia, RTM/Voice of Malaysia		11885as	
		15295as			
1000	1100	USA, Voice of America	9530as	9845as	
		9855as	11965as	13650as	13765as
		15670as			

1100 UTC - 6AM EST / 5AM CST / 3AM PST

1100	1130	China, Yunnan PBS		6035as	
1100	1157	North Korea, Voice of Korea		7220as	9345as
1100	1200 mthfas	China, China Huayi Broadcasting Corp		4830do	
		5050do			
1100	1200	China, Fujian PBS	3990do	5970do	
1100	1200	China, Hulun Buir PBS	3900do	6080do	

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HFGCS – Always ready ... Always on!

None of us will ever forget the tragic terror attacks on New York and Washington on September 11, 2001, and the airliner that crashed in a Pennsylvania field that day. It is an event that will be tragically and forever etched in the history of this country. But, there is a small piece of the story on that day that has pretty much flown under the national public radar, involving a military HF radio system most of us have been monitoring for years.

Shortly after the 9/11 attacks on the World Trade Center and the Pentagon, military radio communications hit critical mass, especially on the various Department of Defense (DoD) military communication satellite networks.

According to officials from the High Frequency Global Communications System (HFGCS), System Program Office at Tinker Air Force Base, "immediately after the 9/11 attacks, satellites were saturated with users, causing many of them to shut down. This crippled the ability of many military units and Government officials to coordinate a response to the event."

Even satellite communication on Air Force One was hindered. Eventually, thanks to a simple, but elegant HF radio network known as the HFGCS radio system, operators at Andrews AFB were able to reconnect Air Force One into the communications loop, enabling air-to-ground phone calls via HF.

Looking back on monitor reports from that day and in the days that followed, HFGCS was the one radio network that many radio hobbyists tuned into to get a realtime perspective on the disaster.

❖ The History of HFGCS

This DoD radio system has a rich lineage that dates back to the Cold War era. It evolved from several radio systems used by the MAC, SAC, and TAC Air Force commands, as well as other networks from the US Navy, that were active during the Cold War. What is now known as the High Frequency Global Communications System (HFGCS) used to be called the Global High Frequency System or GHFS.

GHFS began on June 1, 1992, and was created out of two earlier HF networks, the "Giant Talk" HF network used by the Strategic Air Command (SAC), and the Global Command and Control System (GCCS), used by the rest of the Air Force. This consolidation reflected the reorganization of the Air Force following the end of the cold war, with SAC becoming part of United States Strategic Command (STRATCOM), the Tactical Air Command (TAC) becoming the Air Combat Command (ACC), and the Military Air Command (MAC) becoming the Air Mobility Command.

They also consolidated several U.S. Navy radio networks, most notably the Navy HICOM network, into this new Joint Chiefs of Staff supported HF radio system.

GHFS became the HFGCS network in 2003, on completion of the multi-year equipment upgrade called "Scope Command," and the network master control station for this radio system was placed at Andrews AFB in Maryland.

For several years, many in the monitoring community referred to the GHFS/HFGCS as the Scope Command network. Actually, the SCOPE Command was an equipment program administered by the HFGCS program office at Tinker. The aim of the program was to upgrade and modernize the then 15 high frequency (HF) ground stations worldwide associated with the GHFS network.

The United States Air Force's high power, high frequency radio system, installed during the 1960s and 1970s, had become logistically unsupportable. The SCOPE Command program replaced the older HF radios and associated control equipment, as used by the SCOPE Control, SCOPE Pattern, and SCOPE Signal III radio systems, with state-of-the-art, commercially available equipment and the latest computerized control techniques.

❖ Current HFGCS Specs

Today, the HFGCS has proven to be a highly effective, networked solution for providing near global communications coverage for both voice and data to DoD aircrews, strategic and tactical forces. The HF Global network is an Air Force acquired and managed system that supports a myriad of Department of Defense beyond-line-of-sight communications missions.

This high-power HF network provides long-range voice coverage of approximately 2,000 miles and data coverage of 2,500 miles from each of its 13 worldwide HF stations. A remote or local operator can select the operating frequencies, sideband selection, transmitter power, antenna selection, and azimuth selection for directional antennas, half or full duplex operation, and initiation of an Automatic Link Establishment (ALE) sequence for each transmitter at each of the ground sites within the HFGCS.

Primary customers that are supported by the HFGCS include the Air Force's Air Mobility Command, Air Combat Command, Air Force Space Command, and the Navy's E-6 TACAMO fleet. Other users include the Joint Chiefs of Staff, U.S. Central, Pacific and Strategic Commands, the U.S. State Department, and many other U.S. government agencies. Other users that are being courted to utilize the HF Global network in the future include the Defense Threat Reduction Agency, FEMA, NSA, AF Auxiliary/Civil Air Patrol, and special DoD missions requiring long-range communications.

One of eight directional rotatable log periodic antennas near Elkhorn, Neb. Telecommunications specialists from the 55th Strategic Communications Squadron, Offutt Air Force Base, Neb., monitor the antennas. (U.S. Air Force photo/Josh Plueger)

HFGCS also supports alert broadcasts of Emergency Action Messages (EAM). EAMs can be sent over the HFGCS network directly from United States Strategic Command through a dedicated circuit to the Master Net Control Station (MNCS) at Andrews or from the MNCS after receiving the alert by other communications channels. The National Command Authority disseminates emergency war orders using Emergency Action Messages.

A major improvement to HF communications has been the incorporation of the Automatic Link Establishment or ALE communications protocol. ALE eliminates the need for operator assistance to complete a call or phone patch. ALE automatically selects the best frequency and ground station and makes the connection, for both voice and data. Users receive the optimum connection available, based on location, time of day and current propagation conditions.

Within the HF Global network, ALE also provides HF email messaging capability, making it possible to send and receive classified email messages to and from appropriately equipped aircraft and ground users. The HF email software used by the system, known as HF Messenger™, also possesses a store and forward ground feature, which holds an email until the addressee aircraft comes up in the HF ALE mode. The email system then makes the connection and transmits the message. A typical 5k email file can be transferred in approximately two minutes. More importantly, it is economical to use since there are no associated per message costs.

The standards that have been implemented in association with HF email delivery include:

- 2G ALE for link establishment.
- Up to 9600 bps modem (STANAG 4539, MIL-STD-188-110B).
- STANAG 5066 and CFTP client used for reliable over-the-air data delivery.
- Standard SMTP email protocols into the ground network.

❖ Four Major Radio Systems

Under the broad umbrella known as the HFGCS, there are four unique missions or radio systems supported by the HFCGS and Scope Command equipment. These four unique missions are: USAF AMC Global HF radio networks, Mystic Star, Inter-American Air Forces Telecommunications Network (SITFAA), and Defense Communications System (DCS) HF entry.

United States Air Force AMC Global

This network supports a wide range of users by providing air-ground-air, ship-to-shore, broadcast, and Automatic Link Establishment (ALE) capability to various DoD customers. It is the military radio network that radio hobbyists commonly listen to.

The Global network consists of four subnets: USAF AMC Global Command Net, Global ALE DSN Gateway Net, Global Black or NIPRnet unclassified email network, and the Global Red or SIPRnet classified email network. I have included a complete list of all the known frequencies for each major Global subnet in the sections listed below.

USAF AMC Global Command Net

(Mode is USB)
Stations in the net:

Andrews AFB, MD (Davidsonville); Ascension Island; Croughton AB, UK; Diego Garcia; Elmendorf AFB, AK; Andersen AB, Guam; Hickam AFB, HI; Lajes AB, Azores; Offutt AFB (Elkhorn), NE; Isabella/Salinas, Puerto Rico; Sigonella (Sicily) Italy; West Coast (McClelland Airfield/Dixon); Yokota AB, Japan. I have been told that Grand Forks, ND, will be added to this network as a NCS-West control station sometime in 2011.

Published Frequencies:
4724.0 6712.0 (Croughton Only) 6739.0 8992.0 11175.0 13200.0 15016.0 kHz
Discrete Frequencies:
2324.5 2414.0 3026.0 3029.0 3032.0 3041.0 3044.0 3062.0 3065.0 3071.0 3074.0 3077.0 3080.0 3110.0 3116.0 3134.0 3140.0 3143.0 3146.0 3295.0 3369.0 4452.0 4495.0 4718.0 4727.0 4742.0 4896.0 5026.0 5687.0 5690.0 5705.0 5711.0 6685.0 6709.0 6712.0 6727.0 6730.0 6733.0 6736.0 6751.0 6754.0 6757.0 6826.0 7330.0 7632.0 7705.0 8101.0 8986.0 8989.0 9013.0 9016.0 9019.0 9022.0 9057.0 9268.5 10265.5 10267.0 10573.5 10575.0 10665.0 10949.0 10995.5 10997.0 11005.0 11178.0 11214.0 11217.0 11220.0 11223.0 11229.0 11232.0 11235.0 11238.0 11241.0 11247.0 11250.0 11408.0 11494.0 11508.5 11510.0 11620.5 11622.0 12201.5 12203.0 12907.0 13203.0 13206.0 13209.0 13212.0 13245.0 13248.0 13763.0 13907.0 14955.0 15010.0 15013.0 15031.0 15037.0 15040.0 15046.0 15094.0 15097.0 15962.0 15964.0 17994.0 17997.0 18000.0 18006.0 18009.0 18021.0 18024.0 18027.0 20098.0 20100.0 20101.0 20631.0 20890.0 24124.0 26707.0 26710.0 kHz

Global ALE/DSN Gateway Net

(Mode is ALE/USB)
Stations in the net:

Andrews (ADW), Ascension (HAW), Croughton (CRO), Diego Garcia (DGA), Elmendorf (AED), Andersen (GUA), Hickam (HIK), Lajes (PLA), West Coast (MCC), Offutt (OFF), Isabella/Salinas (JNR), Sigonella (ICZ), South Atlantic (Falkland Island) (MPA), Yokota (JTY).

Published Frequencies:
3137.0 4721.0 5708.0 6721.0 9025.0 11226.0 13215.0 15043.0 18003.0 23337.0 kHz

Global Black or NIPRnet unclassified email network

Stations in net:

Andrews (ADWNPR), Croughton (CRONPR), Hickam (HIKNPR), Isabella/Salinas (JNRNPR), Lajes (PLANPR), Offutt (OFFNPR), Sigonella (ICZNPR), West Coast (MCCNPR).

Frequencies:
3068.0 4745.0 5684.0 8965.0 11220.0 13242.0 17973.0 20631.0 kHz

Global Red or SIPRnet classified email network

Stations in net:

Andersen (GUASPR), Andrews (ADWSPR), Ascension (HAWSPR), Croughton (CROSPR), Diego Garcia (JDGSPR), Elmendorf (AEDSPR), Hickam (HIKSPR), Homestead-during Haiti Ops (MOBD17DAT), Isabella/Salnas (JNRSPR), Lajes (PLASPR), Offutt (OFFSPR), Sigonella (ICZSPR), Unknown (MOBD21DAT), West Coast (MCCSPR), Yokota (JTYSPR)

Frequencies:
3113.0 5702.0 6715.0 8968.0 11181.0 15091.0 17976.0 27870.0 kHz

Note:

I believe that the MOBD##DAT ALE addresses are mobile data stations that have been developed by Rockwell-Collins and Harris Corporation for use within the HFGCS. The Rockwell-Collins HFDG-300 briefcase and the Harris Corporation Wireless Message Terminal can both be configured to work with the SIPRNet or NIPRNet e-mail networks.

The Mystic Star Network

Another major mission supported by the HFGCS is the Mystic Star network. This is a worldwide communications system, operated and maintained by elements of the United States Army, United States Navy, and United States Air Force under the control of the Defense Information Systems Agency (DISA) Operations Center. This network provides worldwide communications by directly controlling radio equipment located at selected Global HF system stations.

Mystic Star consists of ultra high frequency (UHF) military satellite frequencies and a large HF network that supports Presidential, Vice President, cabinet members and other senior government officials, Joint Chiefs of Staff, VIP (very important persons) and DoD command airborne missions.

The Mystic Star HF network consists of a single master net control station (MNCS) located at Andrews AFB Maryland, inter-station and inter-site circuits, and relay/auxiliary communications subsystems.

Over the past few years I have seen fewer monitor reports on this system. It is widely believed that encryption is the reason for the decline in reported Mystic Star traffic. The frequencies listed below have been recently identified as Mystic Star frequencies and are only a sample of what is believed to be a much larger network.

Frequencies (mode USB):
2528.6 3029.0 4440.6 4446.6 4608.6 4755.6 4761.6 4934.1 5232.6 5335.6 5341.6 5435.6 5690.0 5815.6 5821.6 6733.0 6828.6 6991.6 7323.6 7467.6 7685.6 7691.6 8038.6 8045.6 9019.0 9318.6 10584.6 11051.6 11057.6 11152.1 11464.6 12101.6 12107.6 13438.6 13960.0 14863.1 15037.0 16115.6 16315.6 16321.6 17440.0 17455.6 17461.6 17475.6 17481.6 18021.0 18290.0 18315.6 18321.6 18458.6 19000.6 19458.6 20401.6 23265.0 23431.6 23703.0 25359.6 25441.6 kHz

SITFAA

The Sistema de Información y Telecomunicaciones de las Fuerzas Aéreas de América (SITFAA) or the Information and Telecommunications System of the American Air Forces, is an English, Portuguese and Spanish language network that supports North, Central, and South American Air Force users in 18 countries. This network uses voice and data HF links, and the net control station operated by the 789th Communications Squadron located at Andrews AFB. This unique high frequency radio network passes radio traffic between western hemisphere Air Force members of the System of Cooperation Among the American Air Forces (SICOFAA) organization, 24 hours a day, 365 days a year.

Frequencies: (mode USB):
4764.1 7317.1 7320.1 7929.1 7932.1 7935.1 8059.1 8061.1 8064.1 8067.1 9210.1 11547.1 13218.0 13897.1 13918.1 13921.1 14640.1 14643.1 14646.1 14649.1 15675.1 18367.6 18370.6 18373.6 18376.6 19497.1 19500.1 20860.1 20597.1 20600.1 20860.1 24860.0

DCS HF Entry Networks

This mission of the HFGCS provides HF communications services for tactical units in areas of the world where Defense Communications System (DCS) connectivity is unavailable or insufficient.

Recently reported frequencies (various digital modes):
4595.0 4985.0 5335.0 5370.0 5434.0 5820.0 7362.5 8000.0 8039.0 9417.0 9970.0 10720.0 11410.0 11442.5 14375.0 14667.0 16100.0 16225.0 17480.0 17500.0 18060.0 19510.0 20438.0 20950.0 26650.0 kHz

When major events dictate, I highly recommend monitoring the various nets of the HFGCS radio system.

A common misconception from the "broadband" communications community (i.e., satellite) is that HF is on its last breath, something left over from the Cold War era. But every day, HF proves itself more robust and more resilient, and the HFGCS radio networks are an important communications link during national and international crisis that is always ready . . . always on.

BROADCAST BANDSCAN

THE WORLD OF DOMESTIC BROADCASTING

Doug Smith, W9WI
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http://americanbandscan.blogspot.com

Keeping Records

I suppose many radio hobbyists are, at heart, collectors. People who collect tangible items – stamps, antiques, old cars, Morse keys – may not need a log. They have physical evidence of their collection. Other collectors definitely need a log. Birders would be horrified at the suggestion they should kill the birds they see, stuff them, and put them in a display case! As radio hobbyists, we simply don't have anything tangible to collect. There's no way to put a radio signal in a box. Our log is the only record of the exotic stations we've collected.

Hams have a fairly standard logging form. (I suppose it developed from a very popular logbook sold by the American Radio Relay League for many years. The FCC once required hams to log specific items whenever they transmitted.) Broadcast DXers work on a much less formal basis. No two broadcast logs are alike...

My AM log is ridiculously simple. When I hear a station for the first time, I get out my copy of the NRC *AM Radio Log* – and underline that station's entry. However, I suspect most of you would like something more detailed! The National Radio Club offers log sheets; see the link in the sidebar. The NRC logsheets are also suitable for FM and TV DXing. (I just found my 1990 logsheets, for reception in Madison, Wisconsin; they document reception of long-lost stations like CHTN-720, WCAL-770, CBO-910, and CFYN-1050.)

AM DXers usually aren't particularly interested in the distance to their catches. A 250-watt station 50 miles away may be rare DX if it's on a crowded channel; a station 1,000 miles away may not be exciting reception if it's running 50,000 watts on a clear frequency.

FM and TV DXers, on the other hand, have traditionally been interested in knowing the distance to their catches. A computer spreadsheet is probably the easiest way to track your FM and TV DX. Kentucky DXer Girard Westerberg offers a set of spreadsheets, with the coordinates to possible DX targets pre-entered. There's a link in the sidebar. If you're an AM DXer who is also interested in the distance to your catches, Girard has AM DX spreadsheets as well.

Recorded Audio

Until the 1970s, most DXers had no way of recording the *audio* of the stations they heard. Tape recorders came out shortly after World War II, but they were very expensive. (Before the war, record cutting machines were available, but they were even more expensive, and the blanks couldn't be reused.) The development of the inexpensive cassette tape recorder made it economically practical for most DXers to record DX signals. Many did. Storage of dozens, if not hundreds, of tapes, still limits the degree to which it's practical to keep an audio record of what you hear. Sharing your tapes, while certainly possible, is a bit expensive as well.

Two audio recorders and a paper log.

Today, we have computers and sound cards. Your computer includes basic software suitable for recording your DX: Sound Recorder, for Windows; and Linux and Mac machines also have audio recording capabilities. Your DX recordings are valuable for a number of reasons:

- ***Bragging rights!*** You just logged KNBR-680 San Francisco from your listening post on Long Island; you want to share it with the world. You can post the audio file to your website/blog/etc...
- ***Help in identifying tough catches.*** You logged something on 1590 broadcasting in a foreign language you don't understand. You think you heard them say something about "Milwaukee," but the 1590 station in Milwaukee has been defunct for decades. You can post your recording on a blog/message board/etc.. Someone who understands the language listens to your recording, finds the station was talking about a business on Milwaukee Avenue in Evanston, Illinois, and the station you heard was WCGO there.
- ***Nostalgia.*** As I page through my old logs, I see stations I'd love to hear again but never will. CHOW-1470; KHLT-1010; WKKN-1150. Unfortunately, I didn't think to record any of these, even though I did have a tape recorder back then. I do have hours of tape of one of my favorite FM DX stations, KFMH-99.7. That one's gone forever, too.
- ***Safety.*** These days, I do most of my DXing in the car. I'm sure most of my fellow motorists would rather I not try to write down my loggings in a notebook while riding down I-24 at 70mph. I use small audio recorders (see photo). The silver one on the left is an Olympus VN-4100. This will record nearly a day of voice-quality audio on internal flash memory. Recordings are stamped with time and date. I bought it at an office-supply store in Knoxville for about $40. The black one on the right is a Zoom H-1. This sells for $100. The audio quality is a lot better, and the recordings are .wav or .mp3 files which can be transferred to a computer.

❖ "Un-disappearing" Station Re-disappears

The on again, off again saga of CHSC-1220 is finally over. The Canadian Radio-Television and Telecommunications Commission had refused to renew the station's license, having found it had violated a number of broadcasting regulations. The station appealed the decision – but the courts have refused to hear the appeal. This station is now gone forever.

At almost the same time, the other remaining station on 1220 in Ontario also disappeared permanently. CJUL in Cornwall, Ontario had been off the air for awhile. They finally got around to surrendering their license for cancellation.

A third Ontario station on 1220, CJRL in Kenora, moved to FM 89.5 a few years ago.

❖ An Unusual Petition

The FCC has refused to forcibly "undelete" an FM translator station in New Jersey.

In 2008, the New Jersey Public Broadcasting Authority asked the FCC to cancel the license of translator station W276BX, Pompton Lakes. The station had been used to relay the signal of WNJP-88.5. NJPBA's request was routinely granted in January 2009.

I might guess there was a bit of amusement at the FCC's Media Bureau when, a month later, they received a Petition for Reconsideration. WGHT-1500, the local AM station, asked the Commission to deny NJPBA's request to cancel the W276BX license. Quoting the petition, cancellation is "contrary to the public interest, and harmful to the welfare and safety of the residents of Pompton Lakes."

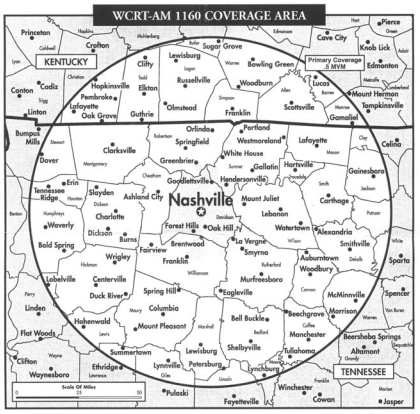
The Commission denied the petition, stating that the FCC has no authority to *force* anyone to hold a license if they don't want it! WGHT wasn't willing to give it up: they filed another Petition for Reconsideration. And, the second Petition discloses the reason why WGHT

was so insistent that the W276BX license remain valid: "WGHT(AM)'s authority to utilize an FM translator, and to provide service at night, will be eliminated if W276BX is not reinstated..."

FM translators are low-powered relay stations, designed to extend the coverage of FM stations by bringing their signals into areas predicted to receive service but blocked by terrain. They could only be used to relay FM stations; AM stations couldn't take advantage of this service.

Until last summer, that is. At that time, the Commission agreed to allow FM translators to relay AM stations. Where the AM station was required to go off the air at sunset, the FM relay station could remain on the air 24/7. There was, however, an important condition: only *existing* translators could be used to relay AM stations. An AM station cannot obtain a license for a *new* translator and use it to relay the AM signal. (Actually, that condition might be a moot point. The FCC is not currently accepting applications for new translators: their database shows 25,000 such applications already on file and it could take decades to sort them all out...)

Anyway, what this meant was that WGHT, a daytime-only AM station, now had the opportunity to acquire an FM signal, and one that can broadcast 24/7. If NJPBA hadn't canceled the W276BX license, WGHT could have acquired it and gone from daytime-only to fulltime broadcasting. However, W276BX was the *only* existing FM translator whose coverage conicided with WGHT's AM coverage. With W276BX gone, WGHT's ability to quickly obtain a nighttime signal is also gone.



Daytime coverage area of WCRT-1160, Nashville.

They do still have the option of acquiring a translator somewhere else and moving it to Pompton Lakes. AM station WNOV-860 recently did this, buying W273AT Port Washington, Wisconsin and moving it to Milwaukee. This is not an easy process. For legal reasons (having to do in part with the 25,000 pending new-station applications), there is a severe limit to how far you can move an FM translator in a single step. WNOV needed five steps to get from Port Washington to Milwaukee. WGHT could face a similar multistep move – if it's even possible.

What's not clear from this story, is whether WGHT had already contacted NJPBA about purchasing the translator. It would seem to me it would have made sense for NJPBA to sell the unused translator license to WGHT – getting some money for it – rather than simply surrendering it for cancelation. But it's possible NJPBA didn't know about WGHT's interest. Once the license was surrendered, it was too late to get it back.

❖ 'Til Next Month

The 1610-1700 kHz expanded band has just celebrated its 15th anniversary. It's no longer the wide open DX heaven it was when there were only a literal handful of stations, but it's still a very interesting piece of spectrum. What are you hearing up there? Write me at 7540 Highway 64 West, Brasstown NC 28902-0098, or by email to *dougsmith@monitoringtimes.com*. Good DX!

URLs IN THIS MONTH'S COLUMN

http://americanbandscan.blogspot.com
My DX blog.
www.nrcdxas.org/catalog/books/index1.html
NRC Publications, including log sheets.
www.dxfm.com/Content/spreadsheet_info.htm
Girard Westerberg's DX Spreadsheets.
www.zoom.co.jp/english/products/h1/
Zoom H1 audio recorder, used for keeping track of DX in the car.

STATION REPORT

NEW:

Applications filed for new stations:

Reno, Nevada	1180	7,500/670 ND (previously-filed application reinstated)

Permits granted for new stations:

Prescott, Arizona	1240	1,000/1,000 ND
North Las Vegas, Nevada	1430	5,000/370 DA-2
Lemont, Pennsylvania	1490	1,000/270 ND
Alpine, Texas	1490	1,000/950 ND
Summersville, W. Va.	1230	1,000/1,000 ND

New stations on the air:

Jerome, Idaho	940	KDIL

Applications for new stations dismissed:

Greenville, Georgia	1560	
Wolfforth, Texas	1560	

Stations deleted:

Farmington, New Mexico	1280	KRZE
Cornwall, Ontario	1220	CJUL
Corry, Pennsylvania	1370	WHYP

CHANGES:

Frequency & location changes requested:

Kalamazoo, Michigan	1440	WKPR	from 1420; 2,700/24 ND

Frequency & location changes granted:

Northbrook, Illinois	1550	WZRK	from Lake Geneva, Wisconsin
Cornwall, New York	1150	WWLE	from 1170; 2,500/500 DA-2
Ten Sleep, Wyoming	1140	KZMQ	from Greybull

Frequency & location changes on the air:

Huntington, West Virginia	1200	WNBL	from 1470; 22,000/9 ND

Frequency & location change requests denied:

Soda Springs, Idaho	800	KBRV	from 790

Callsign changes:

Robertsdale, Alabama	1000	WBZR	from WNSI
Tuscaloosa, Alabama	1280	WMXB	from WWPG
Black Canyon C., Arizona	710	KBMB	from KMIA
Jackson, California	1340	KVGC	(new station)
Santa Barbara, California	1490	KSPE	from KIST
Susanville, California	1490	KLZN	(new station)
Colorado Springs, Colo.	1580	KREL	from KKKK
Atlantic Beach, Florida	1600	WZNZ	from WQOP
Jacksonville, Florida	1320	WJNJ	from WBOB
Jacksonville, Florida	1460	WQOP	from WZNZ
Riviera Beach, Florida	1600	WHTY	from WMNE
Augusta, Georgia	1230	WEZO	from WNRR
Augusta, Georgia	1340	WYNF	from WSGF
Columbus, Georgia	1580	WIOL	from WEAM
Wichita, Kansas	1070	KLIO	from KFTI
Silver Spring, Maryland	1050	WBQH	from WTOP
Iron River, Michigan	1230	WFER	from WIKB
Bay St. Louis, Mississippi	1190	WMEJ	from WJZD
Raleigh, North Carolina	570	WQDR	from WDOX
Toledo, Ohio	1560	WWYC	from WTOD
Bixby, Oklahoma	1210	KBXO	(new station)
Burns, Oregon	1230	KBNH	from KZZR
Portland, Oregon	970	KXFD	from KCMD
Tillamook, Oregon	1590	KTIL	from KMBD
Nanticoke, Pennsylvania	730	WZMF	from WNAK
Conway, South Carolina	1050	WHSC	from WIQB
Hartsville, South Carolina	1450	WTOD	from WHSC
North Augusta, S. C.	1380	WNRR	from WYNF
Sioux Falls, South Dakota	1520	KZOY	from KSQB
Mexia, Texas	1590	KLRK	from KRQX
Vernal, Utah	1400	KRAM	(new station)
Randolph, Vermont	1320	WCVR	from WTSJ
Claremont, Virginia	670	WRJR	from WPMH
Portsmouth, Virginia	1010	WPMH	from WRJR
Roanoke, Virginia	910	WFJX	from WWWR
Vancouver, Washington	910	KKSN	from KTRO
Park Falls, Wisconsin	980	WPFP	from WNBI

ND: non-directional
DA-N: directional at night only
DA-D: directional during daytime only
DA-2: directional all hours, two different patterns
DA-3: directional day, night and critical hours, three different patterns

BOATS, PLANES, AND TRAINS

PLANES

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References for Aircraft Listeners

Listening to and understanding aircraft communications can be enjoyable, but understanding all of what you hear can be challenging at times. To fully enjoy listening to aircraft communications, you really do need to know what is going on up there in the sky, as well as what aircraft are doing on the ground prior to takeoff and after landing.

Pilots and Air Traffic Controllers must learn and have access to a considerable amount of information relating to aircraft, weather, radio communications, navigation, rules and regulations, and more. The very fortunate thing is that this information is readily available to listeners as well – volumes of it. Seasoned aircraft listeners enjoy figuring out what they don't know as part of the hobby. It can be a continual learning process.

In this issue, we will look at some of the myriad useful references and how you can access them. Many can be browsed on line or downloaded as PDF documents and saved for easy access and reference. Saved PDF documents may be easily searched for desired terms. Let's take a look.

❖ Pilot/Controller Glossary (P/CG)

Newcomers who are not familiar with this useful reference should take a look. It may answer many questions about what you hear on the radio. The pilot-controller language is not like any other and this is the reference that helps to make it more understandable. This glossary is an important one for our hobby!

The purpose of the *P/CG* is to promote the use of common words and phrases for pilots and controllers. Entries in bold are the ones you will most likely encounter as a listener. Terms marked "[ICAO]" are those published by the International Civil Aviation Organization (ICAO) when they differ from Federal Aviation Administration (FAA) definitions.

Entry example: *CLEARED FOR THE OPTION - ATC authorization for an aircraft to make a touch-and-go, low approach, missed approach, stop and go, or full stop landing at the discretion of the pilot. It is normally used in training so that an instructor can evaluate a student's performance under changing situations.*

Browse P/CG: **www.faa.gov/air_traffic/publications/atpubs/PCG/index.htm**

Download P/CG: **www.faa.gov/air_traffic/publications/ATPubs/AIM/aim.pdf** – 11.5 MB, 118 pages.

The FAA provides an enormous amount of information for pilots and controllers which also greatly benefits aircraft communications listeners.

❖ Aeronautical Information Manual (AIM)

"This manual is designed to provide the aviation community with basic flight information and ATC procedures for use in the National Airspace System (NAS) of the United States."

The chapters are: Air Navigation, Aeronautical Lighting and Other Airport Visual Aids, Airspace, Air Traffic Control, Air Traffic Procedures, Emergency Procedures, Safety of Flight, Medical Facts for Pilots, Aeronautical Charts and Related Publications, and Helicopter Operations.

There is a great deal of good info in this publication. Among the informative chapters is the one on Airspace. Listeners can benefit from learning and understanding the different types of airspace.

Browse AIM: **www.faa.gov/air_traffic/publications/atpubs/AIM/INDEX.HTM**

Download AIM: **www.faa.gov/air_traffic/publications/ATPubs/AIM/aim.pdf** – 11.5 MB, 711 pages.

❖ Airspace for Everyone

Talking about airspace, here is an Aircraft Owners and Pilots Association (AOPA) publication with lots of good information and illustrations in just 16 pages. "In this Safety Advisor, we will examine the airspace structure and how pilots are expected (and required by the Federal Aviation Regulations) to operate within it." It starts with Uncontrolled Airspace. There are many different types and classes of airspace. It is presented nicely here.

Download: **www.aopa.org/asf/publications/sa02.pdf** – 3.3 MB, 16 pages.

❖ Airspace Basics

This is Chapter 3 from the *Interagency Airspace Coordination Guide* and relates to "airspace issues involving USDA-Forest Service and the Bureau of Land Management (Pacific Northwest Region)."

Despite the intended audience, there is a lot of good info here and with details you may not find assembled like this in one place.

At the outset, it says: "The national airspace is divided into two broad categories, controlled and uncontrolled airspace. Within these two categories, there are a variety of classifications which determine flight rules, pilot qualifications, and aircraft capabilities required in order to operate within any section of the airspace. The specific classification of any area is determined by the FAA and is broadly based upon these: Complexity or density of aircraft movements; Nature of operations conducted within the airspace; Level of safety required; and National and public interest."

Download: **www.airspacecoordination.org/guide/Chapter03.pdf** – 3 MB, 46 pages.

Links to other chapters and information: **www.airspacecoordination.org/guide/index.html**

❖ Air Traffic Control (JO 7110.65)

This is the official Air Traffic Controller's handbook. If you want to see the primary reference they use, this is it. It has lots and lots of information (about 600 pages), so don't be turned off by that. Remember that you can search the downloaded PDF for whatever term you want.

The chapters are: General; General Control; Airport Traffic Control- Terminal; IFR; Radar; Nonradar; Visual; Offshore/Oceanic Procedures; Special Flights; Emergencies; Traffic Management Procedures; Canadian Airspace Procedures; and Decision Support Tools.

Browse: **www.faa.gov/air_traffic/publications/atpubs/ATC/index.htm**

Download: **www.faa.gov/documentLibrary/media/Order/ATC.pdf** – 4.5 MB

❖ Flight Services (JO 7110.10)

This is the manual for Flight Service Specialists / Flight Service Stations (FSS). Pilots

may contact the specialists for various types of information and services. It should be noted that they are not air traffic controllers and they have their own specialty.

They handle certain types of emergencies. They offer Inflight Services. "Inflight services are those provided to or affecting aircraft in flight or otherwise operating on the airport surface. This includes services to airborne aircraft, airport advisories, delivery of ATC clearances, advisories or requests, issuance of military flight advisory messages, EFAS, NOTAM, SAR communications searches, flight plan handling, transcribed or live broadcasts, weather observations, PIREPs, and pilot briefings."

The manual includes many examples of the spoken phraseology consistent with their responsibilities and is a resource to listeners who listen to their communications.

You may be in an area where you can hear HIWAS broadcasts. "Hazardous Inflight Weather Advisory Service (HIWAS) is a continuous broadcast of inflight weather advisories including summarized AWWs, SIGMETs, convective SIGMETs, CWAs, AIRMETs, and urgent PIREPs." These are frequently broadcast on VOR navigation station frequencies in the AM mode in the 108-118 MHz band. Tune through this band and listen on each VOR station you receive. If there are any VORs with HIWAS broadcasts in your area, you will find them. If you use aero charts, the information box next to a VOR will have a "W" in the upper right corner if it transmits HIWAS.

En Route Flight Advisory Service (EFAS) / "Flight Watch" is for local area weather information using 122.0 MHz. For weather info over an entire route, pilots can contact Flight Watch often on 122.2, 122.4, or 122.6 MHz, but there are others. The trick on this is that the specialist will respond on the nearest VOR station. Aero chart VOR info boxes will give the call-in frequency and, of course, the VOR frequency.

Browse: **www.faa.gov/air_traffic/publications/atpubs/FSS/index.htm**

Download: **www.faa.gov/documentLibrary/media/Order/FSS.pdf** – 1.6 MB, 370 pages.

❖ Contractions (JO 7340.2)

This publication is useful in several different ways. First, its entries are not all strictly contractions, but also abbreviations, acronyms, and initialisms. In any case, they are all shortened forms of longer terms. They help with brevity in spoken and written FAA communications.

As stated in the publication: "This handbook contains the approved word and phrase contractions used by personnel of the Federal Aviation Administration and other agencies that provide air traffic control, communications, weather, charting, and associated aviation-communication services. Also contained are aircraft-type designators; civil aircraft company three-letter identifiers and telephony designator assignments; aircraft nationality assignments; and civil/military aircraft-type designators."

Example 1: Let's say you hear "PIREP" (pie-rep) on the radio. To look that up (or another term) go to *Chapter 2, Section 1. Decode,* and if using the HTM / Browse version, click on the link for the first letter. When that comes up, look in the alphabetical list. PIREP decodes to "pilot weather report." That may not satisfy your curiosity, so to get additional information, go to Google **www.google.com** and enter, as an example, all *between* the brackets [PIREP "pilot weather report"]. Using the quotes ties the three words together and narrows search results. You will find plenty on that subject.

Example 2: Call signs and three-letter identifiers – US Airways, another example, uses "CACTUS" as the radio call sign and "AWE" in written form. US Airways Flight 1024 would be heard as CACTUS TEN TWENTY-FOUR on the radio and written as AWE1024.

If you want to decode "CACTUS," go to Chapter 3: AIRCRAFT COMPANY / TELEPHONY / THREE-LETTER DESIGNATOR, Section 2: TELEPHONY / AIRCRAFT COMPANY / THREE-LETTER DESIGNATOR DECODE, and click on the letter "C." CACTUS will be listed in alphabetical order in the Telephony column and in that line will be the company name and the three-letter identifier.

If you have the three-letter identifier and want the rest, go to the same chapter but to Section 3: THREE-LETTER DESIGNATOR/ AIRCRAFT COMPANY/TELEPHONY DECODE, and click on the letter "A." AWE will be listed in the "3-Ltr" column and with the remaining information presented on that line.

In a similar fashion, for the three-letter identifier and the radio call sign for US Airways, go to the same chapter but to Section 1, and click on the letter "U."

Just as a side note, FlightAware has a fleet search. Go to **http://flightaware.com/live/fleet/** and you will find "AWE US Airways 'Cactus' (Tempe, AZ)" listed. Click on that, or any listed airline, to see the airborne planes for that company.

Browse: **www.faa.gov/air_traffic/publications/atpubs/CNT/CNTHME.htm**

Download: **www.faa.gov/documentLibrary/media/Order/CNT.pdf** – 4 MB, 511 pages.

❖ Instrument Flying Handbook

This publication, which has great graphics, can be helpful to the serious listener who wants a better understanding of what the aircraft are doing as we listen.

The chapters are 1. Human Factors (20 pages), 2. Aerodynamic Factors (18 pages), 3. Flight Instruments (38 pages), 4. Airplane Attitude Instrument Flying, Section I (14 pages) / Section II (14 pages), 5. Airplane Basic Flight Maneuvers, Section I (32 pages) / Section II (30 pages), 6. Helicopter Attitude Instrument Flying (20 pages), 7. Navigation Systems (52 pages), 8. The National Airspace System (32 pages), 9. The Air Traffic Control System (16 pages), 10. IFR Flight (34 pages), 11. Emergency Operations (14 pages), plus Appendices, Glossary, Index (35 pages).

Each chapter is useful in its own way, but Chapters 7, 8, 9, and 10 have the most relevance to aircraft listeners.

Chapter 7 starts with "Basic Radio Principles" and "How Radio Waves Propagate." Topics included are: Nondirectional Radio Beacon (NDB) / Automatic Direction Finder (ADF); VHF Omnidirectional Range (VOR); Distance Measuring Equipment (DME); Area Navigation (RNAV); Long Range Navigation (LORAN); Global Navigation Satellite System (GNSS) / Global Positioning System (GPS); Instrument Landing Systems (ILS); and more!

The topic of Chapter 8 is an important one, too, for listeners. "The National Airspace System (NAS) is the network of United States airspace: air navigation facilities, equipment, services, airports or landing areas, aeronautical charts, information/services, rules, regulations, procedures, technical information, manpower, and material. Included are system components shared jointly with the military."

Chapter 9 - "This chapter covers the communication equipment, communication procedures, and air traffic control (ATC) facilities and services available for a flight under instrument flight rules (IFR) in the National Airspace System (NAS)."

Chapter 10 "is a discussion of conducting a flight under instrument flight rules (IFR). It also explains the sources for flight planning, the conditions associated with instrument flight, and the procedures used for each phase of IFR flight: departure, en route, and approach. The chapter concludes with an example of an IFR flight which applies many of the procedures discussed in the chapter."

All chapters may be found here as separate downloads: **www.faa.gov/library/manuals/aviation/instrument_flying_handbook/**

❖ Location Identifiers (JO 7350.8)

This isn't something that can be read like a book. It encodes and decodes location identifiers for Airports, Navigational Aids, Weather Stations, Flight Service Stations and a lot more. You really have to look this one over to get the feel for it and see if it offers something of value to you.

Browse: **www.faa.gov/air_traffic/publications/atpubs/LID/LIDHME.htm**

Download: **www.faa.gov/air_traffic/publications/** and scroll to "JO 7350.8" and select "PDF," – 17 MB, 1224 pages. Also notice the other publications at this site.

❖ On the Fiction Side

I really like *TRACON* by Paul McElroy. It seemed very realistic, a thriller – "The award-winning suspense novel about Ryan Kelly, an air traffic controller at the world's busiest airport, O'Hare in Chicago."

You can read the reviews at **www.amazon.com/** where they sell the hard cover. It looks like the paperback is still available at **www.japphire.com/Pages/hshop.htm** for $6 - worth every cent. See you next time.

GLOBALNET

Exploring the World of Internet Radio and Television

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Doing it for the Troops

Radio stations for the military you can tune in online

For decades, countries have provided programming content targeted specifically to their armed forces personnel and families. Services like Armed Forces Network in the United States and Canadian Forces Radio and Television in Canada provide music, television and talk radio programming to armed forces personnel both at home and abroad.

While the U.S.'s AFN and others do not stream their broadcasts over the Internet, there are streams online from other countries and networks that can be accessed. These can provide a fascinating look into not only breaking news, but also the daily lives of the men and women serving their countries around the world – even though the broadcasts may not be in English.

BFBS – Tunes for the British troops

The United Kingdom also has its own armed forces radio and television service. British Forces Broadcast Service (BFBS) serves British service personnel in locations from Northern Ireland to Brunei.

The BFBS started in 1943 through the then British War Office (now the Ministry of Defence). The service operates three radio stations: The Forces Radio Station, BFBS Radio 2 and BFBS Gurkha Radio (service for Gurkha service personnel).

Much of the content on BFBS Radio 2 comes from BBC Radio 4 and BBC Radio Five Live while the Forces Radio Station combines a mix of contemporary music, news and entertainment. One of the points of pride for BFBS is that many of their presenters have themselves served operational tours in locations where British Forces are stationed, giving them a unique insight into their audience.

In addition to serving the British Forces stationed around the globe, the BFBS broadcasts a DAB station in the UK for friends and relatives of those in the military. This helps to keep them up to date with current military news and information direct from the source.

From the BFBS Web site, users can gain access to several options of streams. The Forces Radio Station is available on DAB in the UK, and can be accessed from the BFBS Web site anytime. In addition, BFBS Radio 2 can be accessed at certain times when the programming is not a relay of BBC programs. There is information on Web site about the times the Radio 2 stream is available. Users can also access the BFBS Gurkha stream.

The content and the production quality is as good as anything you hear on any of the BBC stations. The music covers a pretty wide range of genres and periods of time, considering the diverse demographic of military personnel they are serving.

BFBS isn't the only British radio service for the Queen's forces. Garrison FM serves locally serving military personnel on bases in the U.K. with a mix of music and talk as well as military specific news. Garrison FM has a sister station, ArmyTalk, which features recorded talk program and interviews. There is no live broadcast studio or presenters; everything is prerecorded and automated through a computer system.

Like BFBS, Garrison FM and ArmyTalk offer programming specifically directed at Gurkha personnel. A schedule of programming can be found at the Web sites listed in GlobalNet links below.

Israel Army Radio

The Brits aren't the only ones providing their armed forces radio through an online stream. Israel's Galatz (Army Radio or Galei Tzahal), is available through FM locally, via shortwave broadcasting to Europe, or online.

The Galatz Web site is written in Hebrew, but I have included a link in my GlobalNet Links this month to the RadioTime listing of Israeli radio stations, and Galatz streams can be accessed from here.

There are two Galatz stations: Galei Tzahal and Galgalatz. Both stations are broadcast in Hebrew, with Galgalatz having, from my own listening sessions, a more contemporary format. The music I heard on Galgalatz during my listening session included English top 40 hits, while Galei Tzahal had more talk and traditional music. During my listening session, light jazz seemed to be the predominant genre.

As military service is a requirement for almost all 18-year olds in Israel, Galatz has a very young and very high listenership in Israel, especially Galgalatz. While most readers won't be able to understand what is being said, the volatility of the region warrants adding Galatz to your stand-by playlist in case of any breaking developments.

Canadian Forces Network

The Canadian Forces Network (CFN) broadcasts a radio station in Europe for all Canadian forces serving in the region. Based in the Netherlands with two FM stations, CFN also operates five FM stations in Germany and one in Belgium.

In addition to the terrestrial broadcasts, CFN also streams their programming online.

Most of the programming I heard was a talk format with news from Canada and discussions of issues that affect the Canadian Forces, but the Web site also promotes that they play a mix of music from oldies to current chart toppers.

Voice of Han

While not in English, Taiwan's Voice of Han does provide some entertaining listening, especially their music programming.

Formally known as Military Radio, China's Ministry of National Defense began operating Voice of Han in 1942, originally in mainland China. It was moved in 1949 to Taiwan.

Currently, Voice of Han operates a mixture of nearly 20 FM and AM radio stations, in addition to a series of mediumwave and shortwave radio stations that broadcast Taiwanese propaganda to mainland China.

As the Voice of Han Web site is in Chinese, I found a few streaming options through a listing on the RadioTime Web site. Each of the streams I found offered a mix of talk and music. During my listening sessions, the music I heard was also in Chinese.

The Pentagon Channel

While the United States does not make their Armed Forces Network available online (much of the programming comes from commercial television and radio broadcast in the States), they do have one source of information that can be accessed both online and by many a cable or satellite providers.

The Pentagon Channel carries news about military related issues, covers historical military topics and spotlights different areas of military life or operations. Much of what is broadcast on The Pentagon Channel can also be found on-demand through their Web site. In addition, many of these podcasts can also be found through iTunes.

If you are looking for military-related programming, news and information, any of these military-focused online stream sources should offer up exactly what you are looking for!

❖ iOS Radio Apps Reviewed!

In my ever-expanding effort to try every single Internet radio application available on iOS operated devices, sometimes I find hidden gems, while other times I get burnt. This month, we will look at a little bit of both as we examine three apps for the streaming enthusiast.

Sticher

First up is Stitcher, which offers up both podcasts and Internet radio streams all in a free app.

While Stitcher does have a good assortment of U.S. radio station streams to choose from, from my experience I found this to be more of a podcast

app. A quick search of your favorite show or topic, or even searching by genre can give you access to thousands of on-demand recorded shows and programs from across the world.

While I couldn't find a stream for RTE in Ireland, for example, there was a podcast of RTE's Morning Ireland program.

As a free app, there really isn't much to complain about. If you are looking for streams, you will have a limited amount of options available to you. If you are looking for programming content on-demand (maybe you missed a morning show, or a sports talk show), Stitcher is a good option to consider.

StreamS

At $4.99 in the iTunes App Store, StreamS is one of the pricier Internet radio applications. So what do users get for an extra buck or two? Essentially, sound quality.

StreamS is separating itself from the competition by offering high fidelity streams of radio station broadcasts in AAC/HE-AACv1/HE-AACv2 format. This brings broadcast quality audio to iOS device users.

Using the app is relatively easy. Finding streams can be done in a couple of different ways. You can search under the "stations" icon by searching under the company that owns the station (in the U.S.) or by genre. You can also select the "more" icon, and then either search by station name or keyword, or you can use the StreamMap to find stations by location. Either way seems to work pretty well at finding stations.

Due to the high quality nature of the streams, you won't find every station you are looking for. But, if you are able to find a station that you enjoy already, hearing it in broadcast quality is certainly an enjoyable experience.

Whether the app is worth the $4.99 download is complete dependent on how satisfied with the audio quality of your current Internet radio app, as well as whether or not your station is available on the StreamS app in the first place.

TuneIn Radio

Finally, we come to TuneIn radio, a RadioTime enabled app that combines streaming stations with the capability to record streams for playback. The app is currently $1.99 through the iTunes App Store

I have been using the WunderRadio application now for quite some time, which also uses RadioTime's database of streams. The thing I loved about WunderRadio was the ease of finding streams by location, as well as the access it gave you to scanner streams and NOAA weather broadcasts through scanamerica.us. But, at $6.99, it is by far one of the most expensive Internet Radio apps in the App Store. I had been searching for a Internet radio app that was less expensive, but still packed the features I was used to.

TuneIn Radio might just be my answer.

While it doesn't have the scanamerica.us streams available, it is a RadioTime enabled app, which means there are going to be a few scanner streams to be found. More importantly, the ease of finding streams from across the globe makes this app a true gem for its price.

Anyone with experience using a RadioTime enabled app or WiFi radio should have no problem getting up and running with their favorite stations, you can even log in to your RadioTime account and access favorite stations from there.

But to me, the feature that separates this app from the rest is the in-app recording function. This is by far the easiest stream recording function I have used to date. You simply tap the record button on the player screen to start, tap stop to end the recording. There is an icon to access all recordings, and everything is labeled and organized very efficiently.

I don't know that it will be a full-time replacement for me for WunderRadio, but it might be my new go-to app for listening to radio station streams. This app is highly recommended.

❖ GlobalNet Goes Social?

You may have seen in recent months where I mentioned starting a GlobalNet Twitter account for readers to follow. Slowly, the account is taking shape, with a few new followers and I am finding more information to post to the feed.

Apparently, the Twitter account was a good idea. Several other *MT* writers have started their own Twitter accounts. You can find information about those in their columns.

I am now working on getting a GlobalNet blog up and running as well. From the blog, you will be able to see my Twitter feed, find links to Internet Radio-related Web sites and more! A link to my blog and Twitter account can be found in the links table below.

In addition to those ventures, I have started a GlobalNet Facebook page! A link to that is included at the bottom of the table as well, or you can search for "GlobalNet" on Facebook and become a fan.

All three of these should help keep us connected, not only between myself and my readers, but our readers can keep in touch with each other, too!

Check out the pages, and be sure to send me any questions or comments for the GlobalNet mailbag!

Until next month, 73s!

GLOBALNET LINKS

BFBS - **http://bfbs-radio.com/**
Garrison FM - **http://s124238437.websitehome.co.uk/garrisonfm/index.php**
ArmyTalk - **http://s124238437.websitehome.co.uk/armytalk/index.php**
Radiotime listing of Israeli Radio stations - **http://radiotime.com/region/c_100358/Israel.aspx?other=true**
Galatz Web site - **www.gglz.net/**
CFN Welcome - **www.europe.forces.gc.ca/sites/page-eng.asp?page=8146**
CFN Audio Streaming - **www.europe.forces.gc.ca/sites/page-eng.asp?page=8033**
The Pentagon Channel - **www.pentagonchannel.mil/**
Stitcher - **http://stitcher.com/home.php**
StreamS - **www.indexcom.com/iphone/home.html**
TuneIn Radio - **www.tunein-radio.com/index.html**
GlobalNet Blog - **http://globalnetmt.blogspot.com/**
GlobalNet Twitter - **http://twitter.com/#!/GlobalNetMT**
GlobalNet Facebook - **www.facebook.com/pages/GlobalNet/171840602849214**

BELOW 500 kHz

DXING THE BASEMENT BAND

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Exploring Natural Radio

A huge area of interest in longwave today is Natural Radio – the monitoring of signals from the Earth itself. Even the general public seems to be getting a taste of things lately. Not long ago, I heard a program on National Public Radio (NPR) dealing with Natural Radio, and it has also been covered in the science sections of mainstream newspapers and magazines.

Simply put, Natural Radio involves the reception of signals generated by an interaction between the Earth's magnetic field, bursts of solar energy ionizing the field, and lightning stroke energy within our atmosphere. Natural Radio signals have intriguing monikers like *Sferics*, *Tweeks*, *Whistlers*, and *Dawn Chorus*. While the basic mechanisms for these signals are understood in most cases, much remains to be learned about when they will occur, how they relate to our "space weather" conditions, and how best to hear them as an experimenter.

Natural Radio typically occurs on frequencies, which, when detected, fall within the audible range of the human ear. These are true electromagnetic RF signals, and not sound waves. However, because they occur on such low RF frequencies (≈100 Hz to 30 kHz) they can be detected directly and amplified for human hearing with basic, yet specialized gear.

Sound energy differs from radio in the sense that it consists of *vibrations of air molecules* and changes of air pressure that are detected by our eardrums. Confusion often results between ELF radio and sound waves, perhaps because the frequencies for both are measured in Hertz (Hz) or kilohertz (kHz). While sound and radio are entirely different types of energy, there is an overlap of the frequencies involved, making it easy to detect and reproduce Natural Radio signals for human hearing.

This month, we'll discuss a number of resources that can be found on this fascinating subject, and cover equipment options for today's Natural Radio listener. We won't go into great deal about *how* these signals are created, as much has been written on this topic in the past – both here and elsewhere. A plethora of information is available online by simply entering the search term "Natural Radio." There are also books covering various aspects of Natural Radio, some of which are listed below.

❖ What Can You Hear?

Sferics – The easiest Natural Radio sound for you to hear is Sferics, which derives its name from the word "Atmospherics." In fact, all you need is an AM radio tuned to a clear frequency for this one. The pops and crackles you hear (most common when lightning is active) are Sferics. This energy can extend well into the upper HF and even lower VHF range of the spectrum. By themselves, Sferics are not very exciting, but they do sometimes precede more interesting signals.

Tweeks – Sferics can give rise to Tweeks, which are short duration signals with a ringing, tonal quality. They are most commonly heard during hours of darkness, and in the winter months. Tweeks have a descending note caused by frequency dispersion as the signal travels between the natural "waveguide" formed by the Earth and the lower reaches of the Ionosphere. Tweeks often mix with Sferics and they increase in number as Natural Radio activity picks up.

Whistlers – These are the best known of all Natural Radio signals, and they can be very impressive to hear. The dispersion effect described for Tweeks also causes the characteristic "swishing" sound of Whistlers, but the duration is longer – much longer – because Whistlers travel in the magnetic field of the Earth over very long paths. It is believed that Whistlers can travel the entire length of a magnetic line of force, reach a conjugate point in the opposite hemisphere, and reflect back over the same path, causing a longer (yet correspondingly weaker) signal after each reflection. Some Whistlers have a distinct, pure note, while others are said to be "breathy." A huge variety of Natural Radio sounds, including Whistlers, can be heard online at **www-pw.physics.uiowa.edu/mcgreevy/#latest**. (Note that the dash after "www" is intentional for this site.)

Dawn Chorus – As an amateur birdwatcher, I can understand why the name "Dawn Chorus" was applied to this type of Natural Radio signal. This phenomenon often occurs at or near sunrise, and it sounds similar to a "chorus" of birds coming awake at the start of a new day. The number of signals and their intensity can vary widely with Dawn Chorus, but such events often make for interesting listening. Chorus is most commonly heard when solar-magnetic storms are occurring. As I write this, we are on the upswing of a new solar cycle (#24), and these signals should be more plentiful.

There are many other types of Natural Radio signals you can hear, but the above types are the most prominent. Be sure to explore the sound link above for more of these sounds and their variants. They are really fascinating to listen to!

❖ Receiving Gear

Let's suppose you've read this far, and would like to try hearing some Natural Radio signals for yourself. The good news is that you can do so for very little cost and complexity. The March and April 2006 issues of *Below 500 kHz* carried a two-part article on constructing the BBB-4 "Bare Bones Basic" receiver, originally designed by Stephen McGreevy, a pioneer in Natural Radio listening and recording. The BBB-4 is a very capable unit that can be used to get your feet wet in Natural Radio and it can even serve intermediate listeners quite well. I still use mine from time to time, despite having another commercially built unit available. For information on article reprints, see **www.monitoringtimes.com/**. McGreevy's original article for the BBB-4 can also be found at his Auroral Chorus website given below. Either way, you'll have the information you need to build one of these simple units.

WEBSITES FOR NATURAL RADIO

- Natural Radio Lab Homepage by Mark Karney, N9JWF:

http://naturalradiolab.com/

- Fascinating history of Natural Radio (which dates back to at least 1859!): **http://naturalradiolab.com/content/view/2/3/**
- American Association of Variable Star Observers (AAVSO) website. Often includes discussions on Sudden Ionospheric Disturbances (SID) events:

www.aavso.org/

- Radio Waves Below 22 kHz, by IK1QFK (Italy):

www.vlf.it/

- VLF_Discussion Group on Yahoo. Membership is open to anyone interested in VLF. (free to subscribe): **http://tech.groups.yahoo.com/group/VLF_Group/**
- Stanford VLF Group (Research-oriented)

www-star.stanford.edu/~vlf/

- Space Weather website with current solar conditions:

http://spaceweather.com/

- Stephen P. McGreevy's Natural VLF Radio Phenomena page:

www.auroralchorus.com/

- McGreevy's Natural Radio Sounds page:

www.spaceweathersounds.com/

- "VLF Story" on McGreevy's site *(If you do nothing else, I highly recommend reading this piece for an overview on Natural Radio)*:

www.auroralchorus.com/vlfstory.htm

Books & Publications for Natural Radio

- The *Lowdown* Journal, monthly publication of the Longwave Club of America (LWCA). Contains monthly column on Natural Radio by Mark Karney, N9JWF. LWCA info at **www.lwca.org**.
- *Radio Nature*, a book by Renato Romero, IK1QFK

Info at: **www.universal-radio.com/catalog/books/5089.html**

- Natural Radio Lab book offerings (via Amazon):

http://astore.amazon.com/natradlab-20

Disclaimer for website URLs: The links in this month's column have been tested at the time of writing, but website addresses can change rapidly, and often without notice! If you experience a link that doesn't work, try entering some key words from the topic into a search engine, and see if you can locate it that way.

- If building a natural radio receiver is not your thing, have you considered using your PC's soundcard to directly receive VLF? It can be done with the appropriate software and antenna. Here are some links along those lines: **http://web.telia.com/~u33233109/saqrx/saqrx.html** (This one is primarily meant for receiving station SAQ [17.2 kHz], but is tunable over a range of 0-20 kHz.)
- Using Spectrum Lab software with your PC for VLF reception: **www.ukaranet.org.uk/beginnerprojects/speclab_install_use.htm**

❖ What's in my Bookmarks?

A popular commercial asks: "What's in Your Wallet?" While I'm not ready to go that far (empty wallets are not very exciting) I *will* share my bookmarks for longwave websites. *MT Express* readers can simply click on the addresses to visit these sites. Others will need to type the URLs in. Some have explanatory text after the addresses, but most are simply listings of the name and address for the site. Some are duplicates of the natural radio sites above, but are included here for completeness.

- Through-ground radio
  www.g0akn.aerthgroup.org.uk/page10.html – Dedicated to John Taylor G0AKN and his Earth Current Experiments
- Radio direction finders (RDF)
  www.angelfire.com/space/proto57/rdf.html
- Radio Astronomy for Scientists Teachers and Students
  www.radiosky.com/
- Natural VLF Radio - Sounds of Space Weather - Stephen P. McGreevy
  www.auroralchorus.com/
- LF Engineering Co. Inc. VLF/LF/MF/HF Active Antennas for research and industry
  www.lfengineering.com/ – Manufacturers of Low Frequency Equipment for LF Communications, Natural Radio Research, AM Broadcast, Marine and Shortwave Radio
- U.S. Coast Guard Navigation Center
  www.navcen.uscg.gov/
- LWCA Longwave Home Page
  www.lwca.org
- The Beaconworld Website
  www.beaconworld.org.uk/index.htm
- VE3GOP Longwave Page
  www.ve3gop.com/
- The 500 KC Amateur Radio Experimental Group
  http://500kc.com/
- Stormwise Lightning Det., Ferrite Rods, VLF Radio Equipment
  www.stormwise.com/
- LW Radio Beacons–Hepburn
  www.dxinfocentre.com/ndb.htm – List of LW aeronautical & marine radiobeacons broadcasting weather information.
- Alexander - Grimeton
  www.alexander.n.se/ – Click the British flag to view the site in English
- World Aeronautical Database
  http://worldaerodata.com/
- DX Tests Info
  www.dxtests.info/
- AirNav
  www.airnav.com/ – AirNav provides free detailed aeronautical information on airports and other information to assist pilots in gathering information for flight planning. It's also useful for some hangar flying on those days when the weather or the checkbook keep you on the ground. Airport details include airport location, runway information, radio navigation aids and communication frequencies, FBO information, fuel prices, and a wealth of other information for pilots. Also tools for airport search, fuel price search, and a fuel stop planner. All searchable, all free.
- W3EEE - Mt. Gretna, PA, U.S.A
  www.w3eee.com/
- Radio Story-Alexanderson Alternator
  http://jproc.ca/radiostor/aalt.html
- European LW/MW History
  www.hermanboel.eu/radiohistory/
- NDB and Fish Net Beacons
  www.w8ji.com/ndb beacon fish buoy net beacons.htm – (Spaces in the URL are intentional) Sire discusses NDB harmonics and Fishing net beacons
- WebSDR-VLF at Delft, Netherlands
  http://websdr.pa3weg.nl/

- Loran History Home - loran-history.info
  www.loran-history.info/
- Longwave DXing Info and Tips
  www.dxing.com/lw.htm
- Listening to Longwave – The World Below 500 kilohertz
  www.universal-radio.com/catalog/books/0024u.html – Information for *Listening to Longwave* book
- DX Zone Links: Longwave
  www.dxzone.com/catalog/Operating_Modes/Longwave/ – Low Frequency radio operations ELF, VLF longwave links
- A Broadband Shielded Receiving Loop For Low Frequency DX Work
  http://members.shaw.ca/ve7sl/burhans.html – VE7SL's article on a Shielded Loop For LF Work
- W8JI_160m, LW, MW
  www.w8ji.com/ – Technical resource and information on receiving and transmitting antennas, amplifiers, radios, baluns, for 160 meters 80 meters and other low bands
- Space Environment Twitter
  www.spacenv.com/~agile/twitter.html – Radio propagation monitoring of Ionospheric space weather effects on VLF, LF, HF reported through Twitter
- Below 500 kHz Blog
  http://below500khz.blogspot.com/ – Not too much here yet, but feel free to add your thoughts!
- NDBRNA > signals
  www.classaxe.com/dx/ndb/rna/index.php
- The 500 KC Amateur Radio Experimental Group
  www.500kc.com/
- Save 500 kHz!
  www.save500khz.org/ – Project to preserve the 500 kHz Marine Distress & Calling Frequency as historically significant
- Aerobeacon & Range history
  http://web.archive.org/web/20020109121306/http://members.aol.com/trekkspill/aerobcn.html

Our featured beacon for this month is **ALP/245 in Elmira, NY**. Who can hear this beacon, and at what distance? We will credit the first correct guesser in the April issue.

See you next month!

RADIO RESTORATIONS

BRINGING OLD RADIOS BACK TO LIFE

Marc Ellis, N9EWJ
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A Face Lift for the Philco; An Alignment for the Majestic

❖ From the Readers

A few more readers have weighed in on my query about whether it would be a good idea to begin introducing more household radios as restoration projects for the column. (As those who have been following the column for awhile know, I had been working almost exclusively with military and ham communication receivers for some time.) Our current dual Majestic/Philco restoration is one result of the enthusiastic support I received for household sets.

Tim Levitski, who voted "yes," is working on a Philco 38-12 that his mother picked up for two dollars at a garage sale some time back. He completed the cabinet restoration a few years ago. And even though the radio is playing, he is now proceeding with recapping and checking resistor values.

Curious about what the 38-12 looks like, I consulted Ron Ramirez's excellent reference *Philco Radio 1928-1942* (Shiffer Publishing, 1993). Among the many color pictures of Philco products, I found one of the 38-12, a nice Art-Deco-influenced table model in a wood-grain cabinet. It's possible that I may have this same radio with an ivory finish up in the attic. If so, it could appear in the column one day.

John Ebeling, now retired, had been working in TV and audio service since 1953. He supports my having decided to go ahead with the restoration of the 38-62. "They were interesting sets in their day, and are still very much liked."

Mike Martel recently acquired two car radios: one for a '38 Pontiac; the other for a '49 Buick. After recapping and realignment, the Pontiac set was put to work as a garage radio. The Buick is a work in progress. Mike asks if the tubes for auto radios were constructed differently because of being subjected to bouncing and vibration. The answer to that is. . . yes, and no. . .

❖ The Sylvania/Philco Loktal

In general, auto radios used the same tubes found in home sets. The vibration and bumps encountered in mobile radio service don't seem to have had much of an impact on tube life. The big problem with short life span was with the mechanical vibrators used in the power supplies. However, there was one tube type designed to lock firmly into its socket. It was developed more as a marketing gimmick than because of a perceived need for a shake-proof design.

In the mid 1930s, RCA developed a range of tubes that was to dominate the market for several years. They had metal bodies and a novel *Octal* (eight pin) base that had a center post equipped with a molded locating key. Not to be outdone, arch rival Philco, in collaboration with Sylvania, developed the *Loktal* – or lock-in tube.

Although the Loktal had a metal base shell, it was a true all-glass tube. The electrical connections to the tube elements were made through heavy pins that passed through the glass base and plugged directly into the tube socket. The shell included a keyed post similar to that on the octal base. However it also incorporated a groove that was captured by a flat locking spring built into the tube socket.

Loktal tubes were used in many Philco radios (although the Model 38-62 we are working on is a bit too early for that). They were no doubt also used in auto radios made by Philco and others, though I don't have specific information on this.

❖ Progress on the 38-62

Regular readers of the column will remember that when I first got inside the Philco 38-62, I found the chassis top terribly rusted through the leavings of a mouse – or probably a mouse family – that had made themselves at home there. The terrible state of the top was one of the reasons why I had at first decided to beat a strategic retreat from the project. The set is quite clean underneath, however – leading me, eventually, to change my mind.

The problem remained of how to make the chassis presentable again. While it's a nice set, and interesting in its way, it's hardly rare enough to go to the trouble of removing all the electronics so that the chassis could be sandblasted and replated. The only answer was to paint it.

Last month I mentioned the excellent product that I'm using, but I'll repeat it for those who might not have seen that issue. The paint is manufactured by Modern Masters of N. Hollywood, CA (**www.modernmastersinc.com/**). It's from their metallic paint collection, Cat. # ME150 Silver. All of the Modern Master metallic paints are available in three different opacities: opaque, semi-opaque and sheer. I'm using the opaque version.

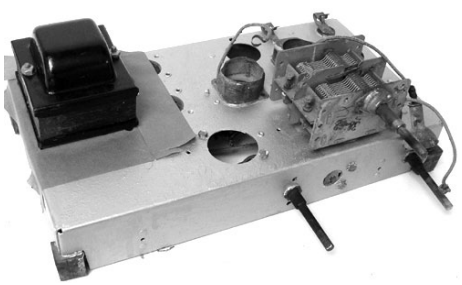

Fig. 1. With Philco chassis refinishing completed, masking was applied in order to repaint power transformer.

In last month's work session, to facilitate cleaning and painting the chassis, I removed the two i.f. transformers and the can-type electrolytic capacitor. These items, too, would be easier to clean when off the chassis. As much as possible of the rust was removed using a small brass-bristled brush, then a primer coat was applied. I used "Kilz 2," a water-based, pigmented, primer-sealer.

This month, I was ready to apply the metallic paint, which – remarkably – is also water-based. As with the primer, I used a 1" brush for the larger areas and a child's paintbrush to get into the tight spots. When this paint first went on it looked disappointing indeed. There were brush marks and small bubbles galore and no amount of rebrushing would smooth them out.

But as the product dried, something magic happened: The bubbles disappeared and the brush marks were somehow absorbed as the paint formed a continuous film. After a second coat had dried, the chassis looked almost as if it had been spray painted. And its color and texture were not too different from that of fresh zinc plating.

The power transformer still looked a bit disreputable, though, so I masked it off from the chassis, gave it a quick workover with the wire brush, and went over it with some heat resistant black enamel from a small can that I happened to have on hand (Figure 1). I painted the shell only – leaving the laminations alone.

This paint, too, proved to be very forgiving, with its brush marks smoothing out on drying. The tired-looking, rusted, transformer now looked almost new. With the transformer masking removed, the chassis top looked very credible indeed. And I no longer felt as if I had to wash my hands after each time I handled it!

❖ Getting Back to the Majestic

Last month we took our first peek inside the little Majestic 5A410 – also known as the "Zephyr" – and I was struck by the very clean condition of the chassis. The set had obviously been stored inside under very good environmental conditions. As I upended the chassis

and prepared to recap the radio – normally my first step in any restoration – I thought, "wait a minute, maybe I should give this set a chance to operate with its original components!" So I plugged it into my isolation transformer – a must when working with hot chassis a.c.-d.c. radios – and turned it on under reduced voltage.

Lo and behold, after I had gradually increased the voltage to 100 or so, the radio burst into life. The sound was a little sharp, even for the little speaker in this minimal set, but there was plenty of sensitivity and I was picking up stations all over the band. That's where last month's work session ended. This month we'll begin with tweaking the alignment.

If you've never tried, or thought about, doing a realignment on a superheterodyne before, working with this radio should be very instructive. It's about as basic and simple a set as they come. But before we begin, here's a quick overview of the circuitry.

❖ The Superhet Signal Path

The signal from the broadcast station enters the radio via loop antenna L1/L2, with L2 forming a tuned circuit with one of the two gangs of dual capacitor C3 (Figure 2). The other gang of C3 forms a tuned circuit with oscillator coil L3, which generates a signal 455 kHz removed from the broadcast station signal tuned by L2/C3.

The two signals are fed to the 12SA7 tube, which is a type known as a *pentagrid converter*. There the signals are mixed, resulting in two new signals; their frequencies are the sum and difference of the radio station and oscillator signals. This tube performs the dual function of oscillator and mixer, which is often done by separate tubes in more sophisticated radios.

It is the difference frequency, which happens to be 455 kHz, that we are interested in. Since the two gangs of the tuning capacitor are turned together as stations are selected, and since the constants of the two tuned circuits are similar, there will be a difference frequency of 455 kHz no matter what station is tuned in.

The 455 kHz signal, known as the *intermediate frequency*, is fed to the 12SK7 i.f. amplifier tube through one i.f. transformer and passes to the detector and audio amplifier circuits of the radio via a second one (Fig. 3). This system of frequency conversion followed by amplification at a constant lower frequency is the secret of the power of the superheterodyne design.

❖ Alignment

Aligning a superheterodyne is a matter of tweaking all the tuned circuits in the various stages of the receiver so that they are set to the correct frequencies. For this work, one needs an accurate signal generator to provide test signals and a meter to show receiver output as the various circuits are adjusted. In this case, since the radio is an a.c.-d.c. set having one side of the line cord connected to the chassis, one also needs an isolation transformer, through which the radio is powered without having direct contact with the line.

Following the instructions on the manufacturer's data sheet, the i.f. channel was aligned first. A modulated 455 kHz signal from the signal generator was fed to the first grid of the 12SA7 through a .01 uF capacitor. My output meter for this project was a vacuum tube voltmeter set to its lowest a.c. range. It was connected across the voice coil terminals of the radio's loudspeaker.

When measuring receiver output by measuring its audio output, as we are doing here, we must keep the volume control turned up close to the maximum. Then we must adjust the output of the signal generator so it is just strong enough to give a meter indication. A signal that is too strong can actuate the automatic volume control circuitry, which would attenuate the signal just when we are trying to maximize it.

With everything set up and the test signal audible on the speaker and showing on the meter, the trimmer capacitors for the i.f. channel (screwdriver adjustments atop the i.f. cans) were adjusted for maximum receiver output. This was done in the order C13, C12, C9, C8 (Figure 3), with the radio set to a quiet spot on the dial.

This adjustment went quite smoothly, and I was able to improve output significantly with a couple of the trimmers. So much so, in fact, that I had to reduce the output of the signal generator a couple of times to keep the signal level appropriately low. I did notice a roughness in the audio tone that I hadn't encountered in other alignments done with this generator, but it didn't seem to interfere with my ability to achieve a clean maximum on each adjustment.

For the final two adjustments (loop tuning and oscillator tuning) the manufacturer's instructions called for the output of the signal generator to be connected to a loop of a few turns formed of stiff wire. This is placed near the radio's antenna loop and parallel to it. Both the signal generator and the receiver are set to 1500 kHz and, as before, the signal generator output is set to a minimum.

The first adjustment is made to C5 (Figure 2 and Figure 3).

This capacitor is connected across the oscillator's main tuning capacitor, and thus serves as a trimmer adjustment of the oscillator frequency.

Moving this trimmer affects receiver calibration, making the signal appear at different positions on the dial. The idea is to adjust so that the maximum output point falls exactly at the 1500 kHz position. Like most oscillator adjustments, this one was a little touchy. A small movement of the trimmer resulted in a large movement of the signal across the dial.

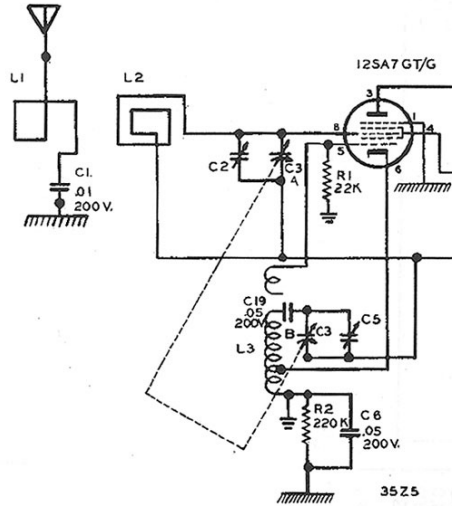

Fig. 2. Schematic of Majestic's front end shows oscillator/mixer circuitry.

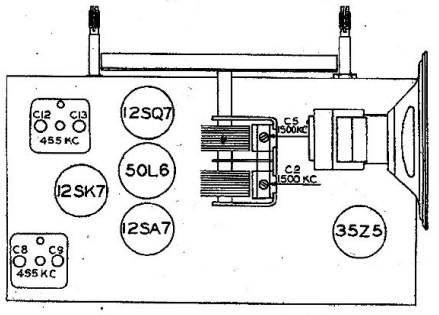

Fig. 3. Majestic chassis layout diagram shows location of all adjustment trimmers.

C2, the loop trimmer (see the same two figures), was the final adjustment. Carefully rocking it back and forth for maximum output completed the alignment. After that I gave the radio another reception test and found it not only much livelier but smoother sounding. The sharp edge formerly heard on some of the stations had disappeared.

❖ My Face is Red!

It has just come to my attention that, throughout last month's column, I referred to our Majestic set as a "Magnavox." What caused me to make this gaffe? Maybe because both brand names are well known, have three syllables, and begin with "M." Apart from that, I can think of no excuse for my "brain spasm." But I do apologize for the confusion I must have caused among my readers!

See you next month, when we wrap up the Majestic restoration and continue on with the Philco.

ANTENNA TOPICS

BUYING, BUILDING AND UNDERSTANDING ANTENNAS

Dan Farber, AC0LW
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The Great Equalizer

Making Your Tuner Work for You

Last month, I took a general overview of the history and science behind the antenna tuner. This time around I'd like to get a little more "hands on" and talk about some of the things we can do to get the most out of our tuners. I realize that there are numerous operators who do just fine without a tuner, and I certainly mean them no disservice. However, they are without doubt operators who can employ full-sized, coaxial cable-fed antennas; or they are listeners using active antennas, or perhaps even the whip antenna on a portable rig. I salute you, one and all. *Anything* that gets you on the air and enjoying radio is a winner in my book.

But – if you are, like me, a ham using ladder-line fed antennas; or if you are using any sort of stealth or random antenna; or if you are forced to use shortened antennas due to space restrictions; or if you are a listener that wants to maximize the results you get from a given antenna – then the antenna tuner is an absolute must in your radio room.

First let's talk about what is meant by an "antenna tuner." Three basic configurations come to mind:

(1) A manually operated tuner, located at the operating position and connected to the radio by a short run of coaxial cable.

(2) An automatic tuner, either sold as an integral-looking add-on for a given brand of radio and mounted right on the side of the rig, or else sold as a separate, integral component and placed in line between rig and antenna as in (1) above.

(3) A remote automatic tuner, located right at the antenna, often located, perhaps even buried, at the base of a vertical, and connected by cables to the indoor radio room.

Make no mistake, option (3) is marvelous if you've got the cash (and the antenna configuration). I've mentioned before that one of these goodies, buried at the base of a flagpole, can be the very best of two worlds: total stealth, as regards the "big antenna in plain sight," and armchair simplicity of operation, as the auto tuner's little brain does all the work of finding and remembering matches for all your favorite frequencies. It's expensive, but if you've got the spare cash, this is a very attractive option to consider.

Option (2) is perfectly fine, too, and is not quite as pricey as the remote unit. Here again, all the "legwork" of operating the tuner and remembering settings is done for you by the tuner's CPU. In addition, for a given make and model of radio, you can now find on the market auto tuners that mount right on the side of your

My trusty MFJ 969 tuner, "supporting" my Yaesu transceiver. (Photo by author)

radio, giving a neat and integral appearance. This can be especially attractive, for example, to the portable operator, who will be grateful for any reduction in clutter and increased simplicity of operation.

❖ The Basics: Less is More

However, friends, as I said at the outset, this month's column is a *hands-on* look at getting the most out of our tuners. To do that, we need option (1), the manually operated tuner. For those as yet unfamiliar with tuners, this is the place to start, anyway. Once we're all acquainted with the general operation of tuners, why, no doubt we can all switch over to fancy automatic models!

In the meantime, don't overlook possible advantages of the manually operated tuner, such as the fact that building one of your own, if you've a mind to, is going to be a lot easier than building your own automatic unit. You can find tuner construction projects in every issue of *The Radio Amateur's Handbook,* published annually by the American Radio Relay League, or in back issues of *Monitoring Times (such as Feb 2008)*, as well as in other radio-related magazines.

Also, learning to operate a manual tuner will give you a lot of insight into how a tuner works. Plus, it's a lot of fun. So, let's see what using the tuner is all about.

Some basic principles should be understood and always kept in mind while tuning. The most familiar setup has two variable capacitors and a variable inductance, or coil. Usually the two capacitors are marked TRANSMITTER and ANTENNA. These are pretty self-explanatory: TRANSMITTER is at the radio end of the circuit, and ANTENNA is...well, you can see where this one's leading. The coil's adjustment is usually marked INDUCTANCE. Manipulating these three values is what gives us the match between our radio's 50 ohm antenna connection and the unknown load presented by a random or shortened antenna.

The two capacitors are marked 0 to 10, with hash marks at and between every number. The coil will be marked A through K, typically, if a switched setting; a more elaborate *roller inductor* setup will have a scale reading 000 through 127 or thereabouts. Realize that the *lower* numbers on capacitor settings are actually *greater* capacitance settings, which might seem a bit counterintuitive. The same goes for the roller inductor, where *lower* numbers are actually *greater* inductance. On a switched coil, A is usually the *least* inductance, and K the *greatest.*

Don't let any of this boggle you, though; the only real purpose of these markings is to help you remember (and write down for future reference) the settings needed for a given band or frequency within that band.

A typical remote automatic tuner. (Courtesy MFJ Enterprises)

The main point to remember is that, at *lower* frequencies, *greater* capacitance and *greater* inductance are needed to find a match. This makes perfect sense, if you're familiar with tuned circuits in a radio; the higher in frequency we go, the smaller the coils and capacitors needed. Your tuner's operating manual will no doubt have a chart giving a rough guide for settings at representative frequencies; but even without such a guide, remembering the principle of *more* capacitance (lower dial numbers) and *more* inductance (lower roller inductor numbers, or farther into the alphabet for a switched coil)

Front and back views of MFJ's dual-power automatic tuner. Courtesy MFJ Enterprises)

for *lower* frequencies will at least get you into the ballpark.

From Theory to Practice

For the shortwave listener, the routine is pretty simple. Get to your "ballpark" settings for a given band, tune in a fairly strong station, and touch up your tuner controls for the best reading on your receiver's S meter. You'll find that not only does the tuner maximize results with minimal antennas, but also has the added benefit of reducing interference from signals outside the tuning range. If you have trouble getting a handle on the ballpark settings, try WWV at 2.5, 5, 10, 15 or 20 MHz as a starting point: it's generally a very strong signal and one of these frequencies is bound to be near your shortwave band of choice.

For the ham operator, it's a bit different. Again, get to your ballpark settings. Find an UNOCCUPIED spot on the band, and apply a VERY small amount of transmitting power (five watts should get you started). No doubt the tuner's SWR meter will show a high value. Slowly adjust the inductance FIRST for the lowest possible SWR value, and then fine-tune with the two capacitors to get a minimum SWR. The two capacitors will interact quite a bit, so be patient. After you get a minimum SWR, you may find that raising the power affects the setting, and you have to touch it up a bit. ALWAYS KEEP THIS TUNING PROCEDURE AS SHORT AND SWEET AS POSSIBLE. IDENTIFY YOURSELF. DON'T KNOWINGLY INTERFERE WITH OTHER STATIONS.

Another thing to keep in mind is that the tuner, properly used, can help minimize unwanted radiation of harmonic and spurious signals. With some experimentation, you'll quickly find that there are usually a number of different combinations of tuner control settings that will give you a match at a given frequency. Always use the one that has the *most* capacitance in the circuit (lowest dial numbers on the two capacitors). This will give you the maximum harmonic and spurious rejection the tuner can provide.

The reason that these multiple valid settings are possible is the fact that the capacitors are independently adjustable. There is a particular style of tuner that uses a single variable capacitor. This is a *differential variable capacitor,* which is a fancy name for two capacitors on a single adjustment shaft. As one increases in capacitance, the other simultaneously decreases. Thus, there will usually only be only one coil and capacitor setting that gives you a match.

Make sure you keep a log of your successful settings, so you can return to them whenever you

MFJ's top-of-the-line automatic tuner, rated 1500 W. (Courtesy MFJ Enterprises)

choose. I have a huge page of these logged settings at my right elbow whenever I'm at the radio. Even if I know the settings by heart, I always double-check to save time and trouble. And make sure to separate your results by antenna, or you'll get really snarled up when you change antennas!

You'll quickly find, if you haven't already, that the tuner is a tremendously valuable tool. My trusty MFJ 969 tuner has been a real trouper in my radio room. I've used its versatility for everything from fine-tuning coax-fed antennas, to making a single 102 foot dipole work on every band from 1.8 to 54 MHz, to turning an ordinary rain gutter into a very effective multiband antenna. Plus, it makes an excellent pedestal for my Yaesu FT-897D transceiver, putting controls and display where I can actually see and access them. And in its black metal cabinet, it just *looks* very cool. I recommend it highly.

I encourage you to visit **www.mfjenterprises.com** and check out their excellent line of tuners, manual and automatic. They've got a tuner for every situation and every budget.

That's our overview of tuners and their use, friends. I'll be back in the April issue with more HF antenna adventures. Happy operating!

GRE PSR-700 Review

By Bob Grove, W8JHD

Two remarkable, new scanners have been released in the past few months. First came the Uniden HomePatrol-1™, quickly followed by the GRE PSR-700 EZ Scan-SD.

Both scanners offer painless programming by including massive factory-loaded memory which can be retrieved by entering your location. We recently introduced the HomePatrol to our readers (October 2010); now let's take a look at the PSR-700.

❖ Simple Styling

A quick look at the front panel of this hand-carried portable reveals its elegant simplicity. There is no keypad, only a navigational button to allow left/right menu selections and up/down volume control. Operation is intuitive, especially when considering the unfamiliar control process.

The other press keys allow such function selections as SKIP to temporarily avoid specifically-selected channels during scan and search sequences; A SELECT/PAUSE button to enter your choices and stop the scan/search sequence; a weather key for instant access to your local NOAA weather broadcast; a POWER ON/OFF key which has a secondary backlight function; and the all-important menu button for setting up your preferences for the scanner's operation.

A squelch knob is on the top of the case alongside the whip, as is an earphone jack for private listening or noisy environment monitoring. A rubber flap on one side protects a POWER ON/OFF switch which prevents accidental activation during transport and also prevents battery drain by keep-alive circuitry during long periods of nonuse.

Another flap on the other side protects a connector for the included USB PC interface cable.

TECH SPECS

Modes: AM and narrow FM
Frequency steps: 3.125, 5, 6.25, 7.5, 8.33, 10, 12.5, and 25 kHz
Selectivity (-6/-50 dB): AM (25-28 MHz), 4/6 kHz; FM (elsewhere) 7/13 kHz
Circuit design: Triple conversion, PLL-synthesized superheterodyne
Antenna input: BNC connector, 50 ohms nominal impedance
Power required: 2AA cells or 5VDC @ 120 mA (nominal) through its USB cable
Operating temperature: 14-140 degrees Fahrenheit (-10 to +60 degrees C.)
Case dimensions: 5-inches H x 2-1/2-inches W x 1-inch D
Weight: 6-1/2 oz.

The 700 is powered by two AA cells (not supplied), either alkaline or rechargeable NiMH. An optional DC cable is available to charge/power the radio in a mobile environment, as is an optional AC adapter for long-term fixed use and battery charging.

The owner's manual is on a CD-ROM which also includes the USB cable driver and the PC application software. A quick-start, folded-paper guide handily walks folks like me who hate to read manuals through the loading and selection process. I found the 700's on-screen menu very easy to follow without the instructions.

❖ Choices Galore

The hand-held scanner comes with a 2GB SD memory card loaded with the United States and Canada's most-sought frequencies, typically law enforcement, aircraft, local and federal government, fire and medical as well as other services present in the database.

The database is provided by a private source, **radioreference.com**, and is updated and augmented on an on-going basis, available on line at no cost, as is the operational software.

The frequency ranges covered are 25-54, 108-174, 216-512, 764-797, 806-960 (less cellular), and 1240-1300 MHz (less cellular).

A service search allows you to poll for activity in specific frequency ranges which are FCC-allocated for the service of your choice, even if an active frequency is not currently listed in the pre-programmed database.

A more comprehensive search is accomplished in the conventional fashion by selecting start and stop frequencies, then automatically and rapidly stepping through the selected bandwidth looking for activity.

Frequencies can be programmed to sound an alarm when activated if you are particularly interested in certain channel activations.

The high-contrast, backlit LCD features a highly-informative alphanumeric readout which can be edited by the user; it shows a bargraph-style signal-strength indicator.

Since trunked radio systems are widespread and growing, especially in metropolitan areas, the 700 tracks analog (not digital) Motorola, EDACS, and LTR systems, both for talk groups and individual communications. It also has decoder circuitry which identifies and displays CTCSS subaudible tones and DCS squelch system codes, but it does not have P25 decoding.

P25 digital modulation is growing widely throughout the country, mandated for intersystem use between public safety agencies, and it is regularly incorporated into trunking systems. However, the cost for licensing and software-implementing it in a scanner is consequential, and the PSR-700 is intended to be an easy-to-use, inexpensive scanner; thus, no P25.

The NOAA weather mode provides SAME local weather alarm features with All Hazards signal decoding. An additional feature is SKYWARN storm spotter monitoring.

A handy Spectrum Sweeper function finds nearby transmissions automatically in any band covered by the database, even if the frequency is not currently included in the listed database. Just as with scan and search functions, unwanted frequencies can be skipped by a simple press of the SKIP key if captured during the sweep.

Users of other scanners may have noted that frequencies shown during this type of automatic detection are not always displayed accurately. The 700 employs a selectable "Zeromatic" circuit which can be invoked to accurately display the intercepted frequency.

❖ The Bottom Line

I found the new GRE PSR-700 intuitively easy to use. The ability to simply turn it on fresh from the factory and push-button select listening targets is very satisfying.

The supplied whip is shorter than those found on most competitive scanners (including other GRE models), which slightly reduces reception range, but if this is an issue, replace it with a high-performance whip like the remarkable Condor). **(www.grove-ent.com/ANT14.html**

The wide-coverage frequency range is inclusive for virtually any VHF/UHF scanning application, including CB, ham radio, public safety, civilian and military aircraft, government, marine, racing, and more.

Audio power to the internal speaker is 300 mW, loud enough for most listening environments, and it is crisp and clear. Its 10% total harmonic distortion (THD) is devoid of the obstructive distortion commonly encountered on some other handhelds. The convenience of

a conventional 1/8-inch earphone audio jack allows that option if the situation demands it.

I did miss the presence of a convenient barrel-style DC jack rather than the USB port we've all become familiar with. And the absence of P25 digital demodulation is disappointing with its widespread use, but I understand the cost issue.

It does not come with a belt clip, but an endless choice of holsters for today's pocket electronics is available at stores everywhere.

All told, this is a feature-packed, wide-frequency-coverage, easy-to-use, hand-held scanner that sells for just under $200, and that's remarkable, indeed.

The GRE PSR-700 (SCN-56) sells for $199.95 plus shipping from Grove Enterprises (1-800-438-8155 or *order@grove-ent.com*).

SafeCeiver Mini-Scanner

By Bob Grove, W8JHD

Yes, it really is this small, and yes, it really is a scanner!

The SafeCeiver was designed as a convenient emergency notification device that can be worn quite inconspicuously. It comes with a secure, low-profile, clear plastic holster with a tight belt clip that just won't let go! The holster is open to reveal the display and to access the four control buttons.

Its compact size and effortless weight makes it a dandy, low-cost substitute for expensive pagers. It has a particular appeal to fire departments, hospitals, emergency medical personnel, school campus security, and roving plant managers. It is best suited for coordinating emergency teams on the scene of fires and explosions, as well as search and rescue/recovery operations.

The SafeCeiver is well adapted for addressing a group such as in coaching, training, crowd control, and event security. It would also be useful for staging and coordinating large productions like concerts, parades, re-enactments, and theater spectacles. It would make a great visitor information monitor for museum exhibits and for the hearing impaired at public events.

A very popular application is for motor sport events; spectators can tune in to hear driver-to-pit-crew communications during races. As a matter of fact, the first version of the SafeCeiver was given the 2005 Bobby Isaac award for the most innovative product in NASCAR's short track program. More than 200 track circuits and series in five countries use the UHF version.

❖ Two Models Available

Two models of the SafeCeiver are currently available: the EV25 (151.000-163.495 MHz, 2500 channel search steps at 5 kHz per channel); and the EU16 (450.000-469.9875 MHz, 1600 channel search steps at 12.5 kHz per channel). I elected to review the V25, since most of my local public safety agencies utilize VHF high band.

Up to five channels may be stored in memory and scanned within one second. Activity on any channel stops the scan sequence, then automatically resumes two seconds after the signal drops out.

Conventional squelch provides effortless listening, but the squelch can be defeated for weak-signal monitoring if necessary. At least 20 hours of continuous operation can be expected from a rechargeable AAA cell (not provided). If more convenient, the unit will operate from a conventional AAA alkaline cell.

Four levels of audio can be stepped by the function buttons, from comfortable, quiet environment to ear-splitting volume that can drive a speaker! This is a convenient alternative if someone opts to use the SafeCeiver without the earphones for a period of time, but doesn't want to miss a call. The 1/8-inch (3.5 mm) earphone jack can be connected to either a stereo or mono earphone or speaker.

❖ Let's Try It Out

Any teensy, yet high-powered device holds immediate appeal for me. I inserted a AAA cell into the appropriate slot in the back of the receiver; a secure, durable slide holds it in place, and a lock prevents it from accidentally coming loose. An ON/OFF key is pressed for three seconds to activate the unit. (Hold for five seconds to turn it off.)

It didn't take long to get five of my local public safety frequencies entered into memory. The large LCD is bold and can be read satisfactory from a variety of angles except from above.

Legends on the display show the tuned frequency in megahertz (readout to 5 kHz on the EV25 and 500 Hz on the EU16) and channel number; a busy icon indicates signal being received; a squelch icon shows that function has been activated; and a bar graph that shows the level of audio selected.

Since the little scanner has only four buttons, obviously they multitask. This takes some getting used to, but it isn't impossible. Some buttons respond to holding versus tapping, and some are simultaneously held in tandem (two buttons at a time) to select various functions. An illustrated instruction sheet is provided to familiarize the new owner with the functions and key presses.

Channels may be scanned or manually selected. The total top-to-bottom frequency range can be auto-searched to find activity. Four of the five channels are dedicated for fixed-frequency memory; the fifth is like the VFO channel on typical scanning receivers; the frequency remains stored unless it is changed by tuning across the receiver's operating spectrum.

I conducted my test of my EV25 during an outdoor festival being held in a nearby town. I ventured through the crowd with the inconspicuous scanner attached to my belt and a lightweight ear bud in my ear.

The friendly sounds of the crowd surrounded me, but as the sheriff's calls went out, I heard those clearly, as well as the fire department transmissions. Even while talking with people I knew, no one seemed to notice the unobtrusive monitor or earphone.

❖ Signal Range

The SafeCeiver is very sensitive – 0.2 microvolts. But, because the SafeCeiver is intended for close-in operation, there is no protruding whip, the antenna is built in. This limits its reception range. The manufacturer says that a conventional five-watt hand-held radio should be detectable 2-3 miles away, and that base stations and repeaters should be receivable for 15-25 miles.

That's probably true for flat unobstructed terrain, but I live in the mountains. I found that repeaters five miles away would dependably break squelch, but that the steep terrain caused some breakup in reception at distances in excess of that.

Defeating the squelch would allow weaker signals to be heard, but the constant background hiss would become distracting and fatiguing. Since the SafeCeiver is targeted to receive close-by signals, distant reception is not a consideration.

❖ Speaker Operation

Substituting an 8 ohm loudspeaker for the 32 ohm ear bud provided easy listening close in, and stepping up the volume produced amazingly loud sound – all from a 1.5 volt battery! But with maximum sound (volume step 4), some distortion became evident from the speaker. Not a problem: step 3 provided room-filling volume with no distortion.

To be fair, the low speaker impedance most likely forced the audio stage to operate in excess of its design limit. A higher impedance speaker would likely sound much better.

❖ The Bottom Line

It doesn't track trunking and it won't hear P25 digital modulation, but for listening to important conventional, local signals when the ultimate in portability or privacy is desirable, this little scanner can't be beat. It comes with a battery and an ear bud. And the price is right.

The EV25 or EU16 sells for $129.95 plus shipping from SafeCeiver (8809 C Augusta Road, Pelzer, SC 29669); Phone 1-864-243-0254, or order on line **www.safeceiver.com**.

SKY SURFING

RADIO FROM THE OUTER REACHES

Keith Baker, KB1SF / VA3KSF
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Get Ready for ARISSat-1!

In previous columns, I've been discussing ways to find, track, listen for, and then communicate through our ever-expanding fleet of amateur radio satellites. In this installment, I'll be sharing some more details of how you can use all of your newfound knowledge to hear (or even work through) a new amateur radio satellite that, if all goes as planned, may soon be gracing the heavens. It's called ARISSat-1, a cooperative amateur radio experiment between AMSAT, RSC-Energia of Russia and more than just a little help from NASA.

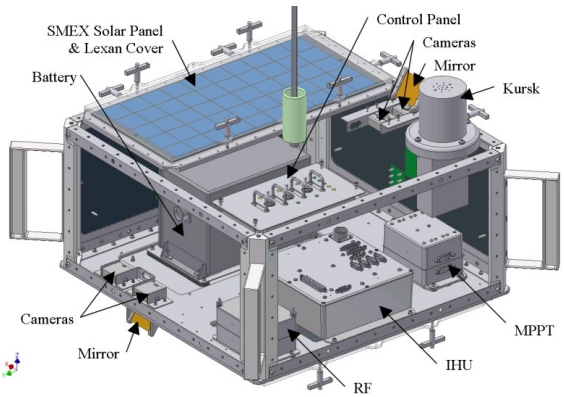
❖ What is ARISSat?

Several years ago, a team led by Sergey Samburov, of the Russian Energia organization, suggested turning a retired Russian Orlan space suit stored on board the International Space Station (ISS) into an amateur radio satellite. The "satellite" would be comprised of an amateur radio transceiver and a battery tucked inside the suit with an antenna mounted on the helmet.

In February of 2006, his brainchild (later dubbed by AMSAT's Lou McFadin, W5DID, as "SuitSat-1") was sent on its way from the ISS. Unfortunately, due to a still unexplained failure of one or more components, SuitSat-1 was extremely hard to hear on the ground. Nevertheless, it continued transmitting a collection of stored messages and other data for the next few weeks until its onboard battery became exhausted.

As a result of the "successful failure" of SuitSat-1, the ARISS organization (Amateur Radio on the International Space Station) immediately began designing what was to be called "SuitSat-2." Unfortunately, their grand plans were cut short in July 2009 when it became painfully clear that, out of necessity to make room on the ISS for some new orbital occupants, the Orlan space suit slated for use in SuitSat-II would have to be discarded.

But, there was a "silver lining" to that news, because the ARISS team would still be offered the opportunity to fly amateur radio equipment up to the ISS on a Russian Progress resupply mission. In addition, the team would still receive a "free" set of solar panels, a spacesuit battery, and a "no charge" Extra Vehicular Activity (EVA) from the ISS to launch it all. The only catch would be that the ARISS team would now have to design and build an appropriate space frame to house the equipment it its own orbit.

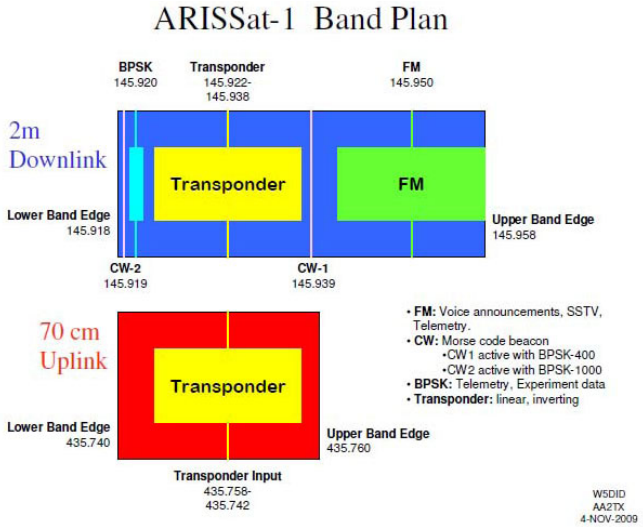


ARISSat-1 contains a large number of RF and digital modules, various on-board experiments as well as solar panels and batteries. (Courtesy: AMSAT-NA)

❖ Revived "Pizza Sat"?

Fortunately, the idea of a satellite tossed overboard from a manned spacecraft was nothing new to AMSAT's visionaries. Long before the ISS was even placed in orbit, AMSAT's experimenters had been toying with the idea of building a small satellite that could be deployed from the Space Shuttle. Indeed, one such "half baked" idea even included tucking an amateur radio transmitter and batteries inside, of all things, a pizza box, mounting a few antennas on the outside of the box and tossing the whole cobbled-together creation overboard. Could this new satellite opportunity actually become the 21st Century manifestation of that decades-old "Pizza Sat" idea?

Indeed, that's exactly what's happened…except this new "pizza sat" (now renamed "ARISSat-1"; its Russian name is RadioSkaf V) will offer users on the ground far more capability than simply another "beep box" in space. For example, once it is deployed in orbit and activated, ARISSat-1/RadioSkaf V will offer simultaneous 2 meter FM, CW, and BPSK and transponder transmissions. These multiple transmissions will come from a completely new, so-called "Software Defined Transponder" (SDX) – the first such transponder to ever be carried aboard an amateur radio satellite.



The ARISSat-1 Band Plan includes provisions for 2m downlink transmissions via FM, CW, and BPSK as well as a Mode U/V linear, inverting transponder. (Courtesy: AMSAT-NA)

Features provided by the SDX include simultaneous 2m FM, CW, BPSK and transponder transmissions – including call sign ID, some 25 spoken FM greeting messages in 15 different languages, select downlink telemetry as well as the call signs of people actively involved with the ARISS program. And, to top it all off, for those so equipped and licensed, the satellite will sport a 16 kHz wide amateur radio U/V linear inverting transponder that will operate between the BPSK and FM signals (see the ARISSat Band Plan diagram).

Another experiment carried onboard ARISSat-1 (provided by the Kirsk State Technical University in Russia) will sample the amount of vacuum around the satellite each day for 90 minutes and will then transmit that information on the downlink to help experimenters and others map the vacuum of space as the satellite slowly spirals into the atmosphere. Six solar panels will supply power to the satellite and recharge the satellite's battery when it is in sunlight. However, once the battery is completely exhausted, the satellite is designed to continue to send data in a low power mode all the while the solar panels are illuminated.

The spoken telemetry values and greeting messages are all designed to help promote science and math education by encouraging school children to listen to the satellite and track its progress. Secret words have also been placed in most of the greetings for which awards will be given to those

correctly identifying them. There will also be a contest and awards given to see who correctly copies the most CW call signs sent. Telemetry data will also be available (in real time via the Internet) to allow school students, interested radio amateurs and other monitoring enthusiasts to study environmental changes that the satellite experiences during its orbits around the Earth.

Unfortunately, as the satellite is not slated to be spin stabilized, it (along with its antennas) will most likely be tumbling in orbit. However, it is hoped that a new 1K BPSK protocol, expressly developed by Phil Karn, KA9Q, will make the satellite's BPSK downlink transmissions more resistant to cross-polarization fading. BPSK data will be sent in between telemetry and Kursk experiment data on the downlink. Free ground station computer soundcard demodulator and display software will be made available via the Internet for multiple computer platforms.

What's even more exciting is that four television cameras are mounted on the top and bottom and on two opposing sides of the spacecraft. These cameras will receive power immediately during the satellite's release and will (again, hopefully!) capture images of the satellite's deployment for later downlink transmission. The cameras are also designed to operate during the rest of the mission and should provide some spectacular views of the Earth and space via Slow Scan Television (SSTV) to those Earth stations so equipped.

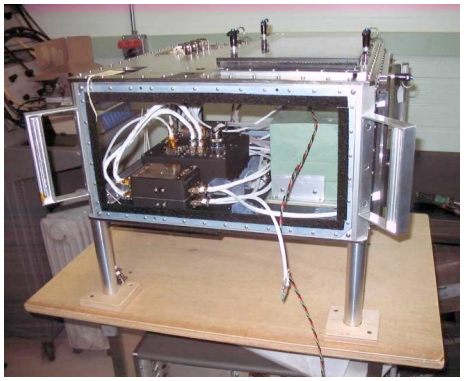
❖ The Launch Plan

If all has gone according to plan, by the time you read this, ARISSat-1 will have already been carried up to the ISS aboard an unmanned Progress re-supply vehicle from the Baikonour Cosmodrome in Kazakhstan. Just prior to ARISSat-1's deployment, crewmembers aboard the ISS will remove the clear Lexan solar panel covers from all sides of the satellite frame.

Then, an as-yet-unnamed ISS crewmember will slowly guide the craft through the open hatch where he (or she) will trip the spacecraft's three control panel switches. Once activated, these switches will start a 15-minute countdown timer to power up the satellite once it is well away from the ISS. The crewmember will then grasp the space frame's corner handles (deliberately made large so as to accommodate their bulky spacesuit gloves) and carefully push ARISSat-1 into its own orbit in a rearward direction from the ISS.

Launching the spacecraft rearward from the ISS helps preclude a later collision with the space station. In fact, the ISS jettison requirement specifically states that a jettisoned object may not get any closer than 200 meters on the first orbit with a minimum launch velocity of -5 cm/sec. The ISS's forward velocity is around 7700 meters/second (about 17,500 MPH), so there won't be much difference in the velocity or altitude of the satellite from the ISS at deployment. This also means that using a set of current Keplerian Elements for the ISS should be sufficient for your computer to track the new satellite, at least initially

Like the ISS, ARISSat-1 is initially expected to orbit at a height around 350 km (220 miles) at an orbital inclination of about 51 degrees…that is, just like the space station, the orbit of ARISSat-1 will be inclined 51 degrees to the Earth's poles. However, as its orbit decays over time, the satellite will gradually spiral down into the Earth's atmosphere and burn up. Hopefully, that shouldn't happen for at least 6 months after deployment. But, exactly how long the satellite will remain in orbit and operational is still anyone's guess.



The flight model ARISSat-1 is shown here just prior to final "button up" and environmental testing. (Courtesy: AMSAT-NA)

❖ How Will I Hear It?

ARISSat-1 will be in an extremely low orbit and will only be transmitting with less than 1/2 watt of power for most of its lifetime. That's because the transmitter output will be divided among all users of the various modes that are switched on at the same time (See the Power Output Table). What's more, because the satellite has no attitude control, its random tumbling may produce "spin modulation" type fading on both the uplink and downlink.

ARISSat-1 Downlink Power Outputs

Power	Mode
250 mW	FM Audio
100 mW	BPSK Beacon
25 mW	CW Beacon
125 mW	SDX (Max Power)

On the other hand, because the satellite is in such a low orbit, the chances of you at least hearing it on high elevation passes at your location using an ordinary VHF/UHF scanner (of the handheld or base station variety) with a somewhat larger whip antenna than a "rubber duck" are probably pretty good. It will certainly be worthwhile to try hearing it using the equipment and antennas you already have.

However, an external (gain) antenna of some sort (such as hand-held Yagis I have discussed in previous columns like the Arrow [**www.arrowantennas.com**] or a hand-held log periodic antenna like the Elk [**www.elkantennas.com**]) may produce better results. These antennas can be rotated with a flick of the wrist as the satellite tumbles overhead. However, a bit more uplink power than 5 watts may be required to *reliably* work through the U/V transponder under all conditions.

Also, because its orbit is slated to be so low (sinking ever lower during its lifetime) the Doppler shift of both its uplink and downlink transmissions will most likely be significant. This means you'll probably need to pre-program several uplink and/or downlink frequencies into your radio in order to keep up with "Dr. Doppler" as the satellite appears to move quickly across the sky.

❖ When Should I Listen?

Initially, the satellite's orbit will closely match that of the ISS, so using computer predictions based on Keplerian elements for the ISS should get you "in the ballpark" as to when and where to listen and point your antennas. However, as the satellite is expected to have both a backward and downward component to its orbit as compared to the ISS, the two objects will eventually separate into two significantly different orbits. By then ARISSat-1 should have its own OSCAR number assigned (with separate Keplerian elements issued by NASA) for far more accurate computer tracking.

❖ Current Status

As this is being written (early December 2010) word had just been received that Russian Customs officials had cleared two flight capable satellites (a flight model and a backup) to be shipped from NASA's Johnson Space Center in Houston, Texas to Moscow, Russia. There, a team led by AMSAT's Lou McFadin, W5DID, was to have instructed Russian Cosmonauts on the power-up sequences and other pre-launch preparations needed to make the flight satellite ready for deployment from the ISS. Fingers are crossed that all has gone according to plan and that the satellite will soon be in orbit and operational… if it isn't already.

I encourage you to stay tuned to the AMSAT Web site (**www.amsat.org**) or the ARISSat Web site (**www.arissat.org**) for continuing updates on the launch and on-orbit status of ARISSat-1, as well as where and how to download computer software to decode its BPSK and SSTV transmissions.

In the interim, those so equipped with a high speed Internet connection can also watch an informative You Tube video of ARISSat-1 at: **www.youtube.com/watch?v=VEDfSCw6VcU&feature=related.** In this 9-minute video presentation (expertly produced by David Larsen, KK4WW) Gould Smith, WA4SXM, AMSAT's ARISSat Project Manager, takes viewers on a virtual tour of an actual working ARISSat-1 engineering model that the ARISSat team had on display at the 2010 Dayton Hamvention®. In the video, Gould also discusses how the satellite will be launched from the ISS and how it will operate once it's in orbit.

❖ Wrap Up

Hopefully, by the time you read this, ARISSat-1 will be well on its way to orbit. However, unless and until that happens, it is important to remember that all of this is, indeed, "rocket science" and a lot of things can interfere with AMSAT's best laid plans to get ARISSat-1 successfully into orbit.

However, if all has gone as planned, I'd be interested in hearing from those of you who have heard or worked through ARISSat-1 via my e-mail address shown above. I'd be particularly interested in how many of you have been able to decode the "secret words" and CW call signs contained in the downlink messages.

In future columns, I'll again be helping you to explore some more interesting aspects of this absolutely fascinating part of our amateur radio hobby. See you then!

How to Cook a Duck
(Device Under Caloric Kinesis)

By Walter Lindenbach

A word to the wise: This article describes a procedure that ***can cause electrocution.*** The voltage involved is "only" 115 VAC, but many more electricians have been killed by ordinary "low-voltage" house current than by 440 VAC or 550 VAC power transmission "high voltage."

"This is a distinctly unsatisfactory situation," said I to me. My poor girl (better half, Lorraine) was lying in the bedroom in great back-pain, having foolishly done something better left for me. But there was no use preaching nor crying over spilt milk.

Two hungry Rottweiler pooches are looking at me in anticipation of dinner. The older one, Magda, looks out of gentle brown eyes that say, "Please Pa, it's dinner time. Do you know when last I ate something? I'm starving right in front of you!"

The younger one, Wilhelm, has brown eyes too, but with a different expression: "Come on Pa, move it! I'm hungry, and you don't want me to eat the cat food, do you? So don't stand there; do something!"

Well, he's right. If something doesn't appear that resembles dinner, he'll go to the bedroom and appeal to Lorraine who, pain or not, will try to get something for them to eat. So, what's to do?

Lorraine calls from the bedroom, "There are wieners in the freezer. They are easy to cook."

Oh, that's nice. I'm so glad. And if the sky falls, we'll all catch larks. Me cook? I can't boil water without burning it. "It's easy." she said. Well, sure it is if you know how. Converting 50 + J 10 to polar coordinates is easy, too, if you know how, but that won't help right now.

"Cook" huh? In the microwave? Naw, they'd probably blow up. Once, a potato blew itself all over the inside of the microwave. Yuk! No more of that, thanks. Put them in boiling water? They'd probably dissolve.

"Pooches, do you want wiener-soup?"

"Anything," say the beseeching brown eyes – all four of them, "but hurry up!"

"Did you find them?" from the bedroom. If I don't answer *yes* quite quickly, she will come and take over. That must not be. Ha, there they are!

"Yes," I sing out. So far so good – now, just cook them. Oh sure! On the stove? I don't know how that thing works.

There is only one way out of this. The process must be treated as a problem in heat transfer. That's the whole business of cooking anyhow, isn't it?

Now, the wieners are at the freezer temperature which is about -10° C. They should be brought to – what? Boiling water temperature? Sounds about right. At an elevation of 4000 feet, which is where we are, what temperature does water boil at? There is a table[1] around here somewhere – yes, here it is. It says, at 4101 ft. elevation (1250 meters – close enough), water boils at 209.6°F. That's 98.7°C. So the wiener temperature must be elevated about 109 Celsius degrees.

Okay, how? Well, resistors get hot when current passes through them, because they're dissipating power. That's nice, but do wieners conduct current? If they do, they could be connected to a 120 VAC power plug, and maybe they'd cook. Better find out. A couple of forks pushed into the ends will make good contact, and an ohmmeter should tell us the resistance.

Now what? The ohmmeter won't work! It indicates a negative resistance! That's nonsense! Well, switch to current – should be DC, shouldn't it? Oh great! There is a current of 60 uA! *The wiener is making a current!* Who would have thought that wieners are that complicated? And she said it would be easy. Humph!

From Theory to Practice

So what's going on anyhow? You can't measure resistance with a current flowing. Ah, contact potential. It's probably a contact potential between the wiener and the fork surfaces. But clearly, they do conduct – that's all I need to know.

Wieners conducting current and dissipating power – think on that! Well, they can't be called wieners anymore. If this were an electrical experiment – which it is – they would be called "Device under Test" or "DUT". But this experiment is supposed to produce dinner, not data. So, to keep us on track, let's call them "Device under Caloric Kinesis" or "DUCK". Hey Pooches, would you like DUCKs for dinner?

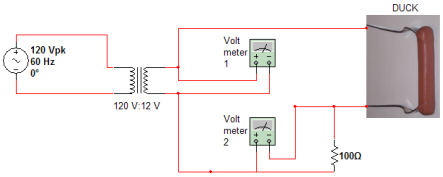
"Woof! That's fine! Anything! Just make it fast, okay? Woof!"

Good. What's next? Well, the microwave cooks things by irradiating them with microwave energy in the Gigahertz frequency range. BUT, heating should be possible at 60 Hz as well – IF I know the resistance.

There are more ways to measure resistance than with an ohmmeter. If there is a voltage across the DUCK, and an ammeter in series, the resistance is $R_{DUCK} = \frac{Volts}{Amps} = \frac{V}{I}$. Yes, *if* we apply DC. But heating will be done with 60 Hz AC, so the measurement should be made with AC. Measuring a small AC current — and it had better be small or the DUCK will start warming during the measurement — can be troublesome, so we'll have to be cute about it.

In Figure 1, Voltmeter 1 will tell us the voltage applied across the DUCK and the 100 ohm resistor, V_1. Voltmeter 2 will tell us the voltage across the 100 ohm resistor, V_2. Now, the voltage across the DUCK is equal to the Voltmeter 1 reading *minus* the Voltmeter 2 reading.

$$V_{DUCK} = V_1 - V_2 = 13.99 - 0.274 = 13.72V$$



And the current in the DUCK:

$$I_{DUCK} = \frac{V_2}{100} = \frac{0.274}{100} = 2.74mA$$

Now, the resistance at room temperature. We'll call it $R_{COLD\ DUCK}$:

$$R_{COLD\ DUCK} = \frac{V_{DUCK}}{I_{DUCK}} = \frac{13.72}{2.74mA} = 5K\Omega$$

What happens if we warm up the DUCK under the hot-water tap? Now the transformer secondary voltage, V_1, is 13.9 V because the transformer secondary current is higher.

$$V_{DUCK} = V_1 - V_2 = 13.94 - 3.48 = 10.46V$$

$$I_{DUCK} = \frac{V_2}{100} = \frac{3.48}{100} = 34.8mA$$

And the resistance at the hot-water-tap temperature. How about $R_{WARM\ DUCK}$?

$$R_{WARM\ DUCK} = \frac{V_{DUCK}}{I_{DUCK}} = \frac{10.46}{34.8mA} = 300\Omega$$

We could calculate the power dissipated by the DUCK, and then – huh?

"Woof!"

Okay, okay, we'll do it experimentally. But just think of the DUCK's negative temperature coefficient. At room temperature, about 20°C, $R_{COLD\ DUCK}$ was 5K ohms, and at the hot-water-tap temperature, 60°C (just checked it), $R_{WARM\ DUCK}$ was 300 ohms. That's a big change! Whatever would the resistance be if the temperature came up to 98.7°C?

$$\frac{\Delta R}{\Delta T} = \frac{R_{WARM\ DUCK} - R_{COLD\ DUCK}}{T_{HOT-WATER-TAP} - T_{ROOM}} = \frac{300 - 5000}{60 - 20} = -117.5\Omega / C\ degree$$

That equation says: "The difference in resistance divided by the difference in temperature equals 117.3 ohms *less* for every Celsius degree of temperature rise." So, if the temperature is increased from 60°C to 98.7°C, $R_{HOT\ DUCK}$, what will the resistance be?

$$R_{HOT\ DUCK} = R_{WARM\ DUCK} + \left(\frac{\Delta R}{\Delta T}\right)(\Delta T) = 300 + (-117.5)(98.7 - 60) = -4247\Omega$$

Negative resistance? Nonsense! Well, while we're being silly, let's see what happens if we start with $R_{COLD\ DUCK}$:

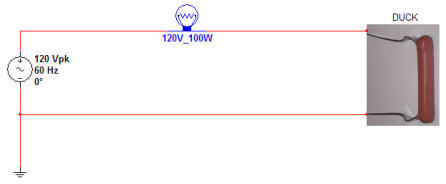
$$R_{HOT\ DUCK} = R_{COLD\ DUCK} + \left(\frac{\Delta R}{\Delta T}\right)(\Delta T) = 5000 + (-117.5)(98.7 - 20) = -4247\Omega$$

Uh-huh, reasonable. Since we're using the same resistance change per Celsius degree, the results should be the same. But this has nothing to do with a real DUCK, because it has no negative resistance; even at the highest temperature there is a real, positive resistance.

Now We're Cooking

So, we still don't know the DUCK resistance at boiling temperature, *but we do know that it will be low*. And that means that, if we plug a DUCK into the wall, there will be excitement! Cleaning up the kitchen after a DUCK flies all over the place is not the way to get dinner. And if these two pooches help –oh mercy!

What's the best way to neutralize a negative temperature coefficient? Put a positive temperature coefficient device in series. Good, like what? Hmmm, what about a lightbulb? The resistance is quite high when the light bulb is on, but when it is at room temperature, it is as much as 10 times lower! So that means that, when power is applied, the light bulb will have a low resistance and the DUCK will have a high resistance. The lightbulb will not light and most of the voltage will be applied across the DUCK. Then, as the DUCK warms up, its resistance will go down, the lightbulb will begin to glow, and its resistance will go up. Figure 2 shows how to do it.[1]



But don't plug it in yet! Be sure the whole business is on an insulating surface, and that the DUCK is on a plate to catch the grease — a plate without metallic trimmings.

When the power is on, i.e. plugged in, DON'T TOUCH ANYTHING! The DUCK will give plenty of cooking evidence: smell and sizzle.

This is what's going to happen when the DUCK is plugged in:

(1) For about 2-1/2 min. after power is turned on, nothing will happen.

(2) The light bulb will begin to glow and, after about 9 min., it will be at near-full brightness.

(3) The DUCK will start smelling good, and emitting juices. Time to pull the plug.

Now, after all this effort, it's time to sample the fare. Yipe! Hot! But not bad, not bad, even if I say so myself, who shouldn't.

"Pooches, no! Not yet! The next one is for Ma. Look out, it's hot! Greedy beast! Didn't even taste it, did you? Okay Magda, you get one, too, then – without stealing it."

So the "cooking" process went on, some more DUCKS were given to the dogs. They were most gratefully received and devoured at a rate that made me wonder if the whole process was not redundant. They probably would have eaten the wieners frozen, cooked or any other way. Right, Doggies? The title picture shows the state that we had come to.

"Woof! More!"

Some went to the bedroom, and Lorraine tried them.

"Say! They're pretty good. How did you do it? You should cook more often!"

Oh goodie! Me and my bright ideas!

Notes

1. Electrical Characteristics of Wieners

The Caloric Kinesis process can be completed much more rapidly if the lightbulb is omitted from the circuit, but with the following concomitants:

(a) There will be burning at the fork-wiener interface. The area is about 6.4 cms^2, and the maximum current density without burning is about 0.1 A/cm^2. At T=+ 90°C, R_{DUCK}≈88 Ω, I≈1.36 A., and the current density is about 0.21 A/cm^2. So they burn. On the other hand, the dogs didn't mind at all.

(b) If the forks come into contact, there will be much excitement and the whole process will be interrupted because the circuit breaker will trip off and the lights will probably go out. If this happens, there will be no time-saving at all, and your dogs, or other hungry guests, will not be pleased.

(c) If a DUCK burns on a fork, cleaning the fork is a beastly business. This, too, machinates against any time-saving.

(d) The benefit of complementary temperature coefficients will be lost, and the process is unstable, i.e. it will "run away". It produces a noisy, messy, and unsatisfactory result.

References

1. "Pocket Ref", Thomas J. Glover, page 13, Sequoia Publishing Inc., Second Edition, 2000.

Walter Lindenbach can be reached at *lindenbachw@shaw.ca.*

What's NEW

Tell them you saw it in Monitoring Times

Larry Van Horn, New Products Editor

2011/2012 Guide to Utility Radio Stations

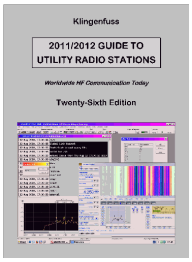
An effective shortwave monitoring post needs three key pieces for success – a good receiver, and good antenna, and a good reference resource.

The Internet offers a plethora of information but, as we've all learned, not all of it is accurate. Many frequency listings are sadly-dated copies of ages-old files and can't be trusted.

Fortunately, there are reliable sources as well, both on the 'net as well as from well-respected publishers. *MT* is certainly one of them, and Joerg Klingenfuss Publications is another.

The annual release of Klingenfuss's *Guide to Utility Radio Stations* is highly anticipated by serious monitors of the under-30 MHz spectrum. This year's 570 pages – his 26th edition – contain some 8300 frequency listings, involving nearly 4000 changes since last year!

Arranged in ascending frequency order from 9 kHz to 28 MHz, listings include call sign or ID, location, agency or licensee, service, and mode as known. A comments field provides additional information as applicable.



The guide book is not simply a frequency guide; it includes charts, tables, and highly informative chapters covering all aspects of receiving utility (non-broadcast) communications in the high frequency (HF) spectrum.

Comprehensive tables abound to help identify some of the unknowns. Call sign prefixes by country (Chapter 6) can be combined with variants shown in Chapter 5 to narrow down the type of service (amateur radio, maritime, aircraft, land mobile, etc.).

A select list of call signs issued by the International Telecommunications Union (ITU) helps identify actual point-to-point, maritime, Coast Guard, and other major installations when their transmissions are received.

Of special interest to meteorology buffs is Klingenfuss's alphabetical-by-country list of global radiofacsimile and radiotelex services. HF Frequencies and scheduled broadcast times are provided. Additional NAVTEX SITOR-B meteo broadcast schedules are given for 424, 490, and 518 kHz and are arranged by seacoast region.

Global meteorological coverage is provided by digital data transmissions throughout the HF spectrum. Klingenfuss has provided screen shots by the hundreds of these as transmitted by military and aeronautical interests around the world. Frequencies are shown for each illustration.

Although the Q code was originally developed for Morse code communications in order to speed up the send/reply sequences between stations, it has grown into wide use among amateur radio operators in voice and data modes, as well as by maritime and aeronautical communicators. A comprehensive list of these signals is included in the Guide.

Another group of expedient abbreviations, the Z code, which was developed by Cable and Wireless, Ltd. for their messaging service, is now found in global use by many texting agencies, especially the military. This list is also provided in the guide.

Voice transmissions often include spelling for accuracy. While it would be understandable that "a is for apple," an international agreement has been reached to use words more familiar to a wide variety of languages; thus, "a is for alpha" in this table! The complete list of phonetics for the 26 letters is given.

The SINPO code is useful for reporting numeric values for various characteristics of a received signal; this information is of interest to the sender so he knows how well his signal is being received. The acronym stands for Signal strength, Interference, Noise, Propagation disturbance, and Overall quality. A table showing these and an expanded version for voice transmissions (SINPFEMO) are in the guide.

There is a table of emission designators used internationally to specify the bandwidths and character of their transmissions; for example, an AM broadcaster might be using 8K00A3EGN. This sequence of several letters and numbers defines the type of modulation (CW, SSB, AM, FM, etc.), the nature or content type of the modulation, (analog, digital, etc.), the nature of the information (voice, telegraphy, video, etc.), information type (mono, stereo, bandsplitting, etc.), multiplexing type (if present), and system type (ARQ, twinplex, multitone, FEC, etc.).

The guide provides a list of the most likely types of modulations/bandwidth characteristics to be found while monitoring the spectrum.

A handy glossary of terms and their definitions regarding radio communications makes a good reference; it is combined with nomenclature of radio bands and frequency units.

For those stalwart maritime/aero monitoring enthusiasts, a convenient listing of discrete frequencies used worldwide on major world air routes for USB voice, as well as the bands used for maritime mobile are also listed.

This reference volume is a must for utilities listeners, and it's also available as a CD from Grove Enterprises and other *MT* advertisers.

– Review by Bob Grove, W8JHD

Scanner Digest

When I first started in the hobby of radio listening, there were dozens of radio clubs you could join that published newsletter on a wide variety of radio related topics. Names like NASWA, Newport News Radio Club, NRC, IRCA, SPEEDX, and the RCMA were staples in the hobby. But time and the internet have pretty much sent most clubs and their publications the way of the dodo bird.

Recently while doing some research on some material for *MT*, I was surprised to find that one of the early scanner publications from the Northeast U.S. is still around and publishing a regular newsletter – *Scanner Digest.*

Back in the early 1980s, a few scanner buffs in the Southeastern Pennsylvania and Southern New Jersey area got together and started to distribute an informal newsletter by mail. The early information, which was photocopied onto a few sheets of paper, was crude by today's standard, but at that time it was the only organized way that scanner monitors could share the information. The idea took off, and soon Les Mattson of Paulsboro, New Jersey headed up a staff of writers – "column editors" as he affectionately called them – and within a year or so he created what became known as the *Northeast Scanning News* or *NESN*.

In the mid-1990s there was some restructuring within the organization and the popular newsletter was renamed *The Scanner Club*. Les continued as publisher/editor until he surprisingly announced his retirement from his duties.

A group effort headed up by Lou Campagna decided that a publication of this type needed to continue, so with the support of many of the former column editors a new publication was born.

The premier issue of the *Scanner Digest* Newsletter debuted back in June 1998. The bi-monthly newsletter was formatted in an easy-to-read printed booklet and continued in printed form until the end of 2002.

High financial costs associated with the graphic layout, offset printing and mailing of a printed newsletter prevented the group from continuing the printed newsletter, so starting with Issue 22 in January 2003, the *Scanner Digest* began to produce the newsletter in the popular Adobe Acrobat PDF format, and now it's distributed electronically to subscribers via email.

If you were a fan of *NESN* or live in the Northeast U.S., drop by the *Scanner Digest* website (**www.scannerdigest.com/**) and sign up for this "free" electronic newsletter.

– Larry Van Horn, NFPW

Books and equipment for announcement or review should be sent to What's New, c/o Monitoring Times, 7540 Highway 64 West, Brasstown, NC 28902. Press releases may be faxed to 828-837-2216 or emailed to Larry Van Horn, *larryvanhorn@monitoringtimes.com*.

When ordering or inquiring about the products mentioned in this column, be sure to tell them that you saw it in the pages of *Monitoring Times* magazine.

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LETTERS

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More Power to You

Mike Colburn had some information to add to the November 2010 *On the Ham Bands* column by Skip Arey, which focused on alternative power sources for hams.

"The article has some excellent safety tips for the operation of gas-fired generators. These devices become worth their weight in gold when commercial power systems experience difficulty. But, there's another threat that users must avoid: backfeed into the electric utility system. If a user attempts to 'plug in' a portable generator directly to their home electrical system, by whatever ingenious means they can muster, it can present an electrocution hazard to utility line workers, and even the public, if high-voltage lines are taken down. With almost 30 years experience as an electric utility engineer, I know personally of at least two cases where employees have been electrocuted due to backfeed from generators.

"The advice about using a dedicated 'power cord system' (i.e. heavy duty extension cord) is very good; it ensures both the backfeed and emissions hazards are addressed. Just don't get 'creative' and attempt to connect the generator directly to your home's electrical wiring; keep it physically and electrically separate.

"BTW – enjoyed the article on Joe Walsh."

Mike Colburn, P.E. (KV6Q), San Diego, CA

And speaking of Skip Arey, we'll share a couple of the compliments he received on his retirement from *MT:*

"I just wanted to say farewell after reading your last column in *Monitoring Time*s. I've enjoyed your work since well before I joined the *MT* staff, and wanted to let you know that your writing style has also had an influence on me. You have an informal, yet no-nonsense style that packs a lot of information into your columns, and keeps things interesting. There are not many other columns in the radio press where I can laugh a little and learn a lot!"

Kevin Carey WB2QMY

"A sincere 'Thanks very much' to T.J. Arey for his always good contribution on *Monitoring Times*. I am among the ones who will miss his writings."

Hector Perez NP4FW

Digging for Discones

Mike Frye forwarded this exchange with a reader named Joe, who wrote following Mike's December article on mobile scanner antennas.

"Saw your article and wonder if you could suggest any web sites or books that I could get info on element lengths for discone/ground plane antennas. I built one similar to the Radio Shack type with a vertical whip, 8 horizontal elements and 8 droopy elements at 45 degrees. There seems to be very little specific info (that I can find) on this type of antenna construction. My main frequency of interest is in the 150 MHz range and I'd like to optimize the elements for that. The elements all are adjustable, i.e. made of whip antenna sections.

"Any help/suggestions would be appreciated."

Joe Wdowiak

A Google search for "discone calculator" will yield lots of on line programs where you can enter frequency parameters and get all the dimensions. Here is one that walks through various discone experiments and has links to some free programs for calculating dimensions: **www.hipoint.ca/whitepapers/WhitePaper_DisconeAntenna.pdf**

Generally a discone is useful over about an 8:1 frequency range and the skirt elements will be slightly longer than 1/4 wavelength at the lowest frequency. An ideal discone is made of a solid sheet metal and if made with elements you would need about 16 for the disc and cone to approximate the performance of a solid sheet metal version. Your choice of 8 elements is probably a good compromise for ease of construction and performance. You should also consider the spacing between the disc and cone will affect the overall match and you may have to adjust this after your antenna is assembled.

The radiation pattern of a discone is vertically polarized mostly at the horizon starting at the low frequency end and up to maybe halfway through its frequency range where the pattern starts to shift upwards. Most commercially made scanner discones have a low frequency cutoff around 100MHz and at 800MHz the pattern is skewed upward, that's one reason many people complain about the 800MHz performance of discones. For your 150Mhz target range it's not a problem and you could copy the dimensions of a Radio Shack version or choose a low end cutoff around 110MHz to give you the VHF aircraft band on up. That should work great through 500 MHz before the pattern gets too squirrely.

The top whip on most scanner type discones are tuned around 50MHz to extend the low frequency range. The whip is sharply resonant and performance peaks at 50MHz but drops off quickly everywhere else. The whips are also base loaded with the coil being somewhat of an RF choke at higher frequencies to try and remove the whip from the circuit at higher frequencies. You have to be very careful considering a low frequency vertical whip on a discone because it doesn't really belong there and can have adverse affects on the VHF/UHF performance if it competes at the higher frequencies.

Discones can be challenging to build as you have probably discovered and I hope yours goes together easily. Please let me know how it turns out and if the info was useful.

Mike Frye

We are sorry to report that Mike, who made a very promising beginning as our quarterly VHF/UHF antenna columnist, will not be able to continue, due to an increase in work load on his demanding "day job." But not to fear: We have an author already stepping into the position. Tune in to our March issue for the "big reveal," as they say on TV.

Old Time Radios

Ron Smith was among those who enjoyed our December issue which featured some nostalgic articles on old-time radios. One of our feature authors, Linton Robertson, received the following email:

"Enjoy your articles in *MT*. In the December issue there is a photo of a '1930's dialset.' I had an identical radio that belonged to my parents restored a few years ago. I remember listening to SW on it in the early '60s, which led me into the life of Amateur Radio around 1962 (WA4FNV). I use it now to listen to late night WSM in Nashville and often to listen to my collection of old radio programs via an AM transmitter designed for realtors – 'Talking House.' It's a great AM broadcaster. Looking forward to more articles. "

Stan Sheram, Athens, Ga. WA4FNV

Another feature author, Eric Beheim, sent this note of appreciation: "I just received my December issue of MT and wanted to let you know how pleased I was with the way my article 'Grandpa Walter's Scott' came out. …Of the articles I've written for MT, this one had the greatest personal meaning. Having it appear in print and to its best advantage has been a very satisfying experience."

Eric Beheim

Antique Radio Classified

John V. Terrey (W5DTQ), publisher of *Antique Radio Classified*, announced that the publication and web site **www.antiqueradio.com**, was sold to Vintage Radio Publishing LLC, a Port Washington, NY based company owned by Jon Kummer (WA2OJK).

Effective November 22, 2010, the contact information for *Antique Radio Classified* is PO Box 1558, Port Washington, NY 11050. Phone 866-371-0512. Email: *jon@antiqueradio.com*. Web site: **www.antiqueradio.com**.

This column is open to your considered comments. Opinions expressed here are not necessarily those of Monitoring Times. Your letters may be edited or shortened for clarity and length. Please mail to Letters to the Editor, 7540 Hwy 64 West, Brasstown, NC 28902 or email editor@monitoringtimes.com

Happy monitoring!
Rachel Baughn, Editor

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Columnist Blogs and Web Sites

These blogs and web pages were created by some of our columnists to better serve their readers. While we highly recommend these resources, they are not official instruments of Monitoring Times.

AMERICAN BANDSCAN
http://americanbandscan.blogspot.com/ - by Doug Smith

BELOW 500KHZ
http://below500khz.blogspot.com/ - by Kevin Carey

FED FILES
http://mt-fedfiles.blogspot.com/ - by Chris Parris

LARRY'S MONITORING POST
http://monitor-post.blogspot.com/ - by Larry Van Horn

MILCOM
http://mt-milcom.blogspot.com/ - by Larry Van Horn

SCANNING REPORT
http://www.signalharbor.com/ - by Dan Veeneman

SHORTWAVE
http://mt-shortwave.blogspot.com/- by Gayle Van Horn

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